An evaluation of water, sanitation and hygiene interventions towards effective response to infectious diseases: A case study of schools in Uasin Gishu, Kenya

Doctoral Thesis

By

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Co- Supervisor: Prof. Ng'wena Gideon Magak

ABSTRACT

Background

Access to safe water, sanitation, and hygiene (WASH) is essential for improving health and educational outcomes, particularly in low- and middle-income countries (LMICs). In Kenya, school WASH implementation remains uneven, with persistent gaps in infrastructure, hygiene practices, and policy implementation. The COVID-19 pandemic exposed these weaknesses and highlighted the need for sustainable WASH interventions to strengthen infection prevention and pandemic preparedness in schools. This study aimed to develop and validate an appropriate WASH intervention for primary schools in Uasin Gishu County, Kenya.

Methods

A multi-phase mixed-methods case study design was employed. **Phase 1A** involved a systematic review of WASH interventions in primary schools in LMICs, resulting in 69 eligible studies. **Phase 1B** comprised a mixed-methods case study in 51 proportionally sampled primary schools (24 rural and 27 urban) selected from 498 schools in the county. Quantitative data were collected using questionnaires and observation checklists, while qualitative data were obtained through focus group discussions with teachers. **Phase 2** utilized a two-round Delphi consensus technique involving 20 purposively selected WASH experts to identify, refine, and prioritize key intervention components. **Phase 3** consisted of a stakeholder validation workshop with 15 experts from the education, health, water, and school management sectors to assess the feasibility, relevance, and acceptability of the proposed intervention.

Results

The systematic review demonstrated that effective school WASH programs are characterized by integrated approaches combining infrastructure improvement, behavior change, and governance support. Promising interventions included hand hygiene promotion, health education, peer-led approaches, menstrual hygiene management, and group handwashing facilities.

The school case study revealed important gaps in WASH provision. While 61% of schools had access to piped water and 67% reported water availability for handwashing throughout the day, 59% lacked soap at handwashing stations and 73% lacked disability-friendly water access infrastructure. Although 75% of schools provided menstrual products, only 22% had changing rooms and 25% had sanitary disposal facilities. In addition, 67% of schools lacked a school WASH policy. Key deficiencies were identified in menstrual health management, disability-inclusive infrastructure, water quality monitoring, and policy implementation.

Delphi findings showed strong expert consensus (74–100% agreement) on the need for dedicated WASH budgets, clear governance structures, inclusive infrastructure, menstrual hygiene management, curriculum integration, monitoring systems, capacity building, and multisectoral collaboration. These findings informed the development of a three-pronged intervention comprising a learner-centred menstrual health guide, a WASH Pyramid Framework, and a policy brief. Stakeholder validation confirmed the relevance, feasibility, and sustainability of these interventions, while identifying inadequate funding, policy gaps, cultural barriers, and sustainability concerns as potential implementation challenges.

Conclusion

This study provides comprehensive evidence on WASH conditions in primary schools and highlights critical inequities in infrastructure, service delivery, and governance in Uasin Gishu County, Kenya. Through a rigorous multi-phase process, it developed and validated a context-specific three-pronged WASH intervention consisting of a menstrual health guide, a WASH Pyramid Framework, and a policy brief. The findings demonstrate that integrated WASH approaches combining infrastructure, behavior change, governance, and policy support are essential for strengthening infection prevention, enhancing school resilience, and improving preparedness for future public health emergencies.

Keywords: Water, sanitation and hygiene (WASH); primary schools; infectious disease prevention; pandemic preparedness; Delphi technique; menstrual hygiene management; Kenya.

DECLARATION 1: PLAGIARISM

I, Gladys Chepkorir Seroney declare that:

i. The research reported in this thesis, except where otherwise indicated is my original research work.

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As the candidate's supervisors we agree to the submission of this thesis

Signed…G. Mchunu 03/11/2025…… Signed 3rd November 2025

Prof. Gugu G. Mchunu Prof. Ng'wena Gideon Magak

DECLARATION 2: PUBLICATION

The publications (published, in print, in press and submitted) that constitute this thesis and the contributions made to each manuscript are presented here.

Publication 1

Seroney, G.C., Mchunu, G.G. and Magak, N.W.A., 2025. Water, sanitation, and hygiene interventions in schools for effective pandemic response in low-and middle-income countries: a systematic scoping review. *Journal of Water, Sanitation and Hygiene for Development*, *15*(9), pp.713-731. https://doi.org/10.2166/washdev.2025.346

Authors' contribution: The author planned and conceived the review and the supervisor read and provided final approval for the manuscript.

Publication 2

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Authors' contribution: The author planned and conceived the review and the supervisor read and provided final approval for the manuscript.

Signed Date 3rd November, 2025.

Gladys Chepkorir Seroney

DEDICATION

I dedicate this thesis to my esteemed family:

To my Dear husband- Dr. Edward Mooka

To my first-born son- Morgan Mooka

To my second born Son- Roy Mooka

To my lovely twin girls- Tracey Mooka

Stacey Mooka

To my parents Pr. Sammy Seroney and Mrs. Joyce Seroney.

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LIST OF ABBREVIATIONS AND ACRONYMS

COVID-19- Coronavirus Disease 2019

DfID- Department for International Development

EFA- Education for All

HFA- Health for All

IFRC- International Federation of Red Cross and Red Crescent

MHM- Menstrual Hygiene Management

SDG- Sustainable Development Goal

SWASH- School Water Sanitation and Hygiene

ToC- Theory of Change

UNGA- United Nations General Assembly

UN- United Nations

UNICEF- United Nations Children's Fund

WASH- Water Sanitation and Hygiene

WASH FIT- Water Sanitation and Hygiene Facility Improvement Tool

WHO- World Health Organization

1.0 CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Water, sanitation, and hygiene (WASH) interventions are actions targeted to prevent and control waterborne and other diseases (Joseph *et al.* 2016). The actions are diverse, including enhancing water supply and storage, improving water quality, proper disposal of human and solid waste, improving drainage, and increasing hand washing opportunities (Strunz *et al.* 2014).

Adequate WASH is vital in shaping both individual and community health outcomes. International recognition of WASH as a fundamental human right has reinforced inclusion as a core target with global development agendas, particularly SDG 6 (United Nations 2010; World Health Organization 2015; Tavia Mirassou-Wolf 2017).

WASH activities have been recognized as fundamental determinants of the population's health status. These determinants are interdependent and interrelated in the way they together influence the achievement of health indicators within communities. UNICEF developed WASH interventions to boost children's health and academic performance worldwide (McGinnis *et al*. 2017).

WASH interventions are used to reduce the transmission risk of diseases, particularly in tropical areas where bacterial and viral diseases are prevalent. Investing in WASH infrastructure is a cost-effective strategy for pandemic preparedness (Howard *et al.* 2020; Ministry of Education 2020; Amankwaa and Fischer 2020). Such investments may help deter outbreaks of infectious diseases, which often impose a huge burden on morbidity and mortality globally (Joseph *et al.* 2016).

When disease outbreaks occur, having safe and adequate WASH infrastructure is important in reducing exposure to disease-causing agents. An outbreak like Covid-19, which primarily spreads through close interpersonal contact and contaminated surfaces, particularly respiratory secretions, its spread is curbed by cost-effective preventive measures such as hand hygiene, mask use, physical distancing, avoidance of crowded and disinfecting shared places (World Bank 2020); (Islam *et al.* 2021). Anthonj *et al.* (2021) highlights that adequate WASH access and quality in schools are crucial for preventing gastrointestinal

and respiratory infections, including COVID-19. Limited WASH services in schools increase children's exposure to pathogens and associated disease risk, particularly given that a substantial proportion of their daily time is spent in the school environment. Evidence indicates that WASH infrastructure in schools is associated with increased infectious, gastrointestinal, neurocognitive and psychological health problems across both low and high-income settings. Insufficient availability of such facilities may also contribute to reduced school attendance rates, greater reliance on open defecation, and heightened exposure of pupils and staff to WASH-related diseases (Morgan *et al.* 2017). School environments have been identified as settings for disease transmission, requiring prevention and control initiatives (Mbakaya, Lee, and Lee 2019). This then motivates the safeguarding of children and educational institutions from disease outbreaks, a noble task.

Providing safe WASH promotes students' right to health and a clean environment. Beyond preventing communicable diseases such as COVID-19, water-related diseases such as diarrhea and other hygiene-related diseases, adequate, safe WASH offer multiple additional benefits, including reduced school absenteeism and lower incidences of diarrheal diseases, gastrointestinal symptoms, soil-transmitted helminths, and respiratory ailments. Moreover, enhanced menstrual hygiene management (MHM) in educational settings has demonstrated positive effects on girls' participation in schooling and academic achievement (Poague *et al.* 2023). Consistent with evidence, Deivam (2016) affirms that WASH improves health outcomes, boosts educational attainment and advances gender equity, particularly by reducing girls' absenteeism during menstruation. Pupils help spread good hygiene habits at home and in their communities, acting as agents of change (McMichael 2019). Good hygiene is estimated to prevent 8% mortality and 10% of morbidity in developing countries (Aschale *et al.* 2021b).

Duijster *et al.* (2017), in their study on school-based WASH programs to improve child health, asserted that WASH is a cornerstone for child health outcomes in low-resource settings. Preventable childhood illnesses like diarrhea, intestinal worms, and dental caries largely depend on access to adequate water. According to Mushi and Shao (2020), the WASH platform offers an opportunity to be leveraged to support the implementation of COVID-19 preventive measures; however, existing WASH platforms in

low-resource settings face similar challenges, such as limited access to water services, insufficient basic hand washing facilities, and inadequate knowledge and awareness of proper hand hygiene practices.

A study carried out in Cambodia evaluating WASH infrastructure, practices, and previous interventions in rural public schools revealed that most institutions depended on untreated water sources, even though functional latrines were limited. Microbiological tests found Escherichia coli in three schools, and none supplied drinking water for students. The study also identified notable disparities in accessing WASH services between rural and urban schools (Tavia Mirassou-Wolf 2017). A study conducted in Tanzania evaluating WASH conditions in schools after the Tanzania National Sanitation Campaign surveyed 70 primary schools. The findings indicated that 53% of these schools maintained a reliable water supply, 43% possessed some operational hand-washing stations, yet only 29% had water available at these stations, and just 19% provided soap. WASH programs in schools proved effective, but insufficient planning, funding, and technical skills limited their success (Antwi-Agyei *et al.* 2017). Evidence has been presented that there is a gap between WASH-related promotion and disease prevention content taught in schools' curricula and the practical implementation of related programs by governments and international organizations. This gap highlights the need for greater attention by researchers and implementing organizations, particularly in examining whether and how curricula knowledge is integrated into WASH activities (Anthonj *et al.* 2021).

Deroo, Walter and Graham (2015) argue in their article that little is known about monitoring and evaluation of school WASH services, given the global scaling being promoted, whereas monitoring conditions and progress is an essential part to assess and improve WASH conditions (RésEAU Brief series 2020). In Kenya, following the introduction of the Kenya policy and guidelines on WASH in schools and the issuance of the health and safety protocol post-COVID-19 in 2020, there has been an urgent need for context-specific interventions. This study, therefore, aimed to develop an appropriate intervention for WASH in primary schools, based on an exploratory study evaluation of Water, Sanitation and Hygiene Interventions towards effective response to infectious diseases in schools in Uasin Gishu

County, Kenya. The findings provide a foundation for improving WASH services in schools, not only during the COVID-19 pandemic but also in the long term.

1.2. STATEMENT OF THE PROBLEM

Clean water, sanitation, food safety, and hygiene in developing countries are crucial for preventing COVID-19 and other diseases, yet they often receive little attention. Since the pandemic, maintaining hygiene has become essential for disease prevention (Gwenzi, 2021). Evidence suggests that schools worldwide, regardless of national income level, often lack adequate water infrastructure, hygiene knowledge, and consistent access to soap (Howard *et al.* 2020). The COVID-19 pandemic brought these deficiencies into sharp focus, demonstrating persistent difficulties in ensuring essential water, sanitation, and hygiene conditions in educational environments (Poague *et al*. 2023)

In Kenya, primary schools are expected to provide basic water, sanitation, and hygiene (WASH) services to promote child health, support learning, and prevent communicable diseases under normal conditions. National and sectoral policies recognize WASH in schools as a core component of school health programs, with provisions for safe water supply, adequate sanitation, hygiene promotion, menstrual health management, and institutional coordination (Ministry of Education and Ministry of Health 2018; Ministry of Education, Ministry of Health and Ministry of Water Sanitation and Irrigation 2024). However, despite the existence of these policy frameworks, the implementation of WASH interventions in many primary schools remains inconsistent, with documented challenges related to infrastructure adequacy, maintenance, behavioral uptake, institutional capacity, and monitoring and evaluation mechanisms (Hope and Tanui 2021; Njambi *et al.* 2020)

Evidence from previous infectious disease outbreaks, including the COVID-19 pandemic, demonstrates that schools with weak WASH systems struggle to effectively prevent and control disease transmission, resulting in increased health risks, school closures, and disruption of learning (WHO & UNICEF, 2020). Although WASH is widely acknowledged as a critical infection prevention and control measure, there is limited systematic evidence on how existing WASH interventions in Kenyan primary schools are structured, coordinated, and operationalized to support preparedness and response to infectious disease

outbreaks and pandemics. The absence of integrated analysis linking policies, institutional arrangements, and implementation practices have contributed to fragmented interventions and limited resilience of school health systems (Bowen, 2009; Fallah *et al.* 2023).

This knowledge gap has significant consequences, as inadequate and poorly coordinated WASH interventions undermine schools' capacity to protect learners and staff during public health emergencies, thereby exacerbating vulnerability to infectious diseases and widening health and education inequalities. Consequently, there is a critical need for context-specific, evidence-based analysis of WASH interventions in primary schools to identify strengths, gaps, and alignment with pandemic preparedness requirements. This study was therefore necessary to systematically examine WASH-related infrastructure and policies, institutional frameworks, and implementation experiences in Kenyan primary schools, with the aim of generating evidence to inform more coordinated, effective, and resilient WASH strategies for infectious disease prevention and pandemic response (Yin, 2003; Bowen, 2009).

1.3 THE PURPOSE OF THE STUDY

To develop an appropriate intervention for WASH in primary schools, based on an exploratory study evaluation of Water, Sanitation and Hygiene Interventions towards effective response to infectious diseases in schools in Uasin Gishu County, Kenya.

1.4 RESEARCH OBJECTIVES

1. Map status of WASH interventions in primary schools in Low- and Middle-Income Countries.
2. Conduct a critical analysis of WASH interventions in primary schools in Uasin Gishu County, Kenya.
3. Develop an appropriate intervention for WASH in primary schools in Uasin Gishu County, Kenya.
4. Conduct a short-term outcome evaluation of an appropriate intervention for WASH in primary schools in Uasin Gishu County, Kenya.

1.5. RESEARCH QUESTIONS

Related to objective 1:

- What are the WASH interventions in primary schools in Low-and Middle-Income Countries?

Related to objective 2:

- What is the input in schools for the implementation of WASH program in primary schools in Uasin Gishu County?
- What are the activities of the WASH program in primary schools in Uasin Gishu County?
- What are the outcomes of WASH interventions in primary schools in Uasin Gishu County?

Related to objective 3:

- Who should be involved in the implementation of WASH program in primary schools in Uasin Gishu County?
- What should be included in the WASH interventions in primary schools in Uasin Gishu County?
- How should the WASH interventions be implemented in primary schools in Uasin Gishu County?

Related to objective 4:

- What are the short- term outcomes evaluation of the developed WASH interventions for primary schools in Uasin Gishu County

1.6 JUSTIFICATION

The government of Kenya is endeavoring to achieve health for all and to meet the SDGs of which providing safe WASH to its population is a component. In fact, WASH is one of the eight thematic areas outlined in the Kenya National School Health Policy. WASH has been identified as a key issue that is important towards the improving of child health outcomes (Ministry of Education and Ministry of Health 2018). This realization aligns with international health organizations who also view WASH initiatives as vital elements of sustainable development that significantly drives people's health and well-being worldwide (WHO and UNICEF, 2017).

Since schools are an integral part of a community, communities become at risk when school children are exposed to diseases because of inadequate WASH. Infections acquired by children in schools frequently extend to household members, affecting up to half of family contacts. The close interaction of large numbers of students and shared use of facilities for extended periods facilitates rapid transmission within schools. Ensuring access to safe WASH facilities is therefore essential for maintaining a healthy and supportive learning environment (Anthonj *et al.* 2021).

Robust and well-managed WASH services are vital to enhance resilience against both emerging infectious diseases and common illnesses such diarrhea, particularly in low-capacity countries that are vulnerable or already affected (World Bank 2020; Ministry of Education 2020; Amankwaa and Fischer 2020).

WASH is a key focus of the National School Health Strategy Implementation Plan 2010-2015, led by the Ministries of Public Health and Education. Targets and outputs were set for identified WASH areas to be achieved by the end of the strategic plan, yet the evaluation of whether these targets have been met has not been reported. In 2020, the Ministry of Education created health and safety guidelines for reopening basic education institutions during the COVID-19 pandemic, which featured the WASH protocol. However, there has been no evaluation or record of how these guidelines have been put into practice in basic education institutions. There is no available report on the evaluation of Kenya's policy and guidelines for WASH interventions. This study is thus highly imperative because it will provide information on the level of WASH implementation in selected primary schools in Uasin Gishu County, Kenya. WASH programs are in operation nationwide, and Uasin Gishu is one of Kenya's 47 counties.

The implementation of WASH in schools will positively impact school-age morbidity and mortality statistics from WASH-related diseases and help achieve the Health for All (HFA) declaration, Vision 2030, and the SDGs. As stated by Hope and Tanui (2021), a lack of effective monitoring and regulation leads to limited oversight, which creates room for misunderstanding and haphazard WASH improvement. It is therefore paramount to investigate the availability and status of WASH interventions in schools.

Location Justification

Uasin Gishu County was selected for this study due to its epidemiological vulnerability to communicable and water-related diseases, policy relevance within Kenya's devolved health system, and demographic composition characterized by a large school-going population. The county has experienced recurrent public health risks, including waterborne and infectious diseases, particularly during periods of heavy rainfall and environmental stress, which have prompted intensified water safety and disease prevention interventions by the county health department, highlighting the need for effective school-based prevention measures (Kenya National Bureau of Statistics, 2023; County Government of Uasin Gishu, 2026). From a policy perspective, Uasin Gishu provides an appropriate setting for examining the implementation of national school health and WASH policies at sub-national level under devolved governance structures. Demographically, the county has a youthful population with a high proportion of children enrolled in public primary schools, making it a relevant context for assessing the role of school WASH interventions in protecting child health and supporting infectious disease preparedness (Kenya National Bureau of Statistics, 2019; Kenya National Bureau of Statistics, 2023).

1.7 SIGNIFICANCE OF THE STUDY

Significance to school pupils

Access to safe drinking water, clean toilets, and hand washing facilities enhances concentration, comfort, and academic performance while creating a safe, clean, and child-friendly learning environment. Proper sanitation facilities promote dignity, privacy, and psychosocial wellbeing, particularly for girls, by supporting menstrual hygiene management and reducing stigma, stress, and school dropout. Effective School WASH programs also help inculcate lifelong positive hygiene behaviors, improve nutritional outcomes through reduced infections, strengthen self-esteem and social acceptance, and enable pupils to act as agents of change by transferring good hygiene practices to their homes and communities, thereby contributing to improved public health, gender equality, and children's rights to health and quality education.

Significance to community

Schools are an integral part of a community, and through them, key health promotion programs can be channeled to the community. This is because school children are known to be good ambassadors of good

health. The results will provide the community with guidance on effective ways to safeguard and enhance the health of schoolchildren, their families, and the wider community.

Significance to education and government

The findings will offer baseline data on school WASH status, helping the Ministries of Education and Health spot gaps in the health-related curriculum. It will also assist the Ministry of Education in identifying areas of the current education curriculum that need strengthening in WASH. The study's results will recommend improving school infrastructure, including building toilets and providing safe drinking water. Governments and donors can use these results to plan resource allocation and help agencies design effective school-based WASH interventions.

Significance to health/hospital

These study findings will provide baseline information on the current status of WASH in schools, which the Ministry of Health can use to further champion for School-led total sanitation in schools that still experience open defecation.

It will also help relevant health professionals prioritize the poorest schools that need specific tailored interventions.

Significance to policy

Kenya is dedicated to universal health and the SDGs, which include safe WASH access. The Ministry of Health's School Health Program policy highlights WASH as a key focus. This study provides national and county governments and other stakeholders with current data on WASH in primary schools. In addition, the results will inform UNICEF and WHO in monitoring WASH progress in schools and assessing Kenyan progress towards achieving Sustainable Development Goal 6. The research will propose interventions to strengthen WASH in schools

To research

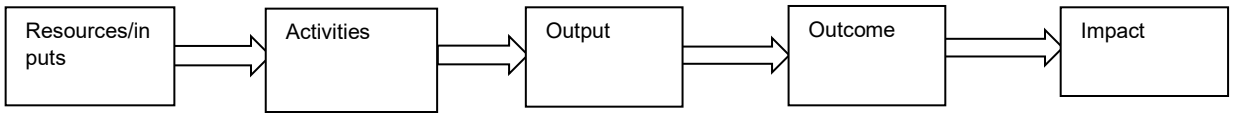
The findings will indicate gaps in School WASH and recommend areas for further research. It will also increase the body of knowledge on WASH in schools.

1.8 CONCEPTUAL FRAMEWORK

1.8.1 WASH FIT Evaluation Framework

The design of this study was guided by the evaluation frameworks for the Water and Sanitation for Health Facility Improvement Tool (WASH FIT) and School Water, Sanitation, and Hygiene (SWASH).

A logic model provides a structured, visual approach to illustrate and communicate the connections among the resources needed to run a program, the planned activities, and the expected outcomes or changes. Logic models have been employed for many decades in program planning, management and evaluation.



Planned work **Intended results**

Figure 1: planned work

Ref: (Kellogg 2004).

The Logic Model components, as shown in Figure 1.0, are explained below. They demonstrate the relationship between a program's planned activities and the intended outcomes.

Resources (inputs): these are human, financial, organizational, and community assets available to support program implementation.

Activities refer to the processes, events, tools, technologies and actions the program undertakes using its resources. Activities are designed to produce the desired program changes.

Outputs are the direct results of program actions, like the amount or audience of delivered services.

Outcomes reflect the specific changes in participants' knowledge, skills, and behavior status or level of functioning.

Impact refers to the long-term effects, both intended and unintended, on organizations, communities, or systems, typically observed within 7-10 years of program implementation (Kellogg 2004; Weber *et al.* 2019).

Logic models have gained popularity as tools for identifying and measuring expected results. They also support planning and management by clarifying objectives, building consensus, highlighting gaps in logic or knowledge, and monitoring progress. Funders have begun to frequently request that community-based programs create logic models, both when applying for grants and for regular monitoring and reporting purposes (Kaplan and Garrett 2005).

1.8.2 Assumptions of logic model components

Resources and barriers refer to the conditions and mechanisms that can either support or hinder the successful implementation of a program. Supportive elements may consist of financial support, established institutions, collaborative partners, formal or informal networks, human resources such as staff or volunteers, available time, physical infrastructure, and necessary materials. In contrast, constraints may arise from negative perceptions, insufficient resources, restrictive policies, legal or regulatory frameworks, and geographic limitations.

Activities encompass the planned actions and operational methods through which a program is implemented. These may involve the use of specific tools, technologies, events, or procedures, and can result in tangible products such as informational materials or curricula, service delivery including training, education, counseling, or screening, as well as the development of systems and capacities required to achieve program objectives.

Output represents the immediate and measurable deliverables generated through program activities. They are commonly quantified by the volume or reach of services and materials produced and serve as indicators of whether the program reached its target population at the intended scale or intensity. Examples include the number of sessions conducted, materials disseminated, participant characteristics and attendance levels, or the amount of time dedicated to various services.

Outcomes refer to the intended short- to medium-term effects of program implementation, typically observed at the individual level. These effects may include changes in knowledge, attitudes, behaviors, skills, health status, or overall functioning resulting from participation in program activities.

Impacts describe the broader and longer-term changes that occur at the organizational, community, or system level because of the program. These may involve improved social or environmental conditions, strengthen institutional capacity, or shift in policies and governance structures.

(Adapted from Kellogg, 2004)

1.8.3 WASH FIT

The WASH FIT is a cyclical, stepwise framework designed to support continuous improvement through practical tools and structured processes aimed at enhancing WASH services. This approach is based on the World Health Organization's core environmental health standards for healthcare settings. In using the WASH FIT framework, we seek to foster a supportive environment by coordinating stakeholders with shared responsibility for service delivery, including policymakers, county health officers, hospital managers, water engineers and community-based WASH and health groups. The goal is to formalize WASH management processes, improve facility operations, and engage communities to support better WASH services and encourage positive household changes.

WASH FIT is grounded in the Theory of Change, a theory-based evaluation approach that emphasizes understanding how and why programs achieve their intended results and supports monitoring and learning across the program cycle. WASH FIT, originally created by WHO and UNICEF in 2017 and revised in 2018, offers a flexible approach for planning, carrying out, tracking, and assessing WASH interventions at various facilities. It focuses on four main elements: input, activities and outputs, outcomes, and impacts (De Silva *et al.* 2014; Maina *et al.* 2019; Weber *et al.* 2019).

WASH FIT evaluation in health care facilities is structured around four key components. Inputs are the political, financial, material, human, and community resources needed for planned activities. Second, activities and outputs encompass the tools, processes, and actions used to implement WASH FIT, such as assessment instruments. Third, outcomes represent intermediate changes arising from these processes, including improvements in staff knowledge of WASH and infection prevention and control practices. Finally, impacts describe the wider, long-term effects on health care facilities, such as enhancements in the quality of care.

1.8.4 Conceptualizing WASH FIT for WASH in schools

Resources/ inputs:

The WASH FIT was conceptualized in this study for WASH in schools since from review of literature WASH FIT was more appropriate because its focus on four components: input, activities and outputs, outcomes, and impacts that makes it easy for planning, carrying out, tracking, and assessing WASH interventions. The framework was appropriate to be used to evaluate WASH in schools since it is grounded on theory of changes which uses theory-based evaluation approach. The WASH FIT framework has been utilized and modified to fit School WASH as illustrated in Figure 2. With regard to resources, strong political support, involvement from the County and national government, and assistance from development partners and donors can help start and sustain WASH programs in schools. This effort requires clear national policies, guidelines, and standards to support the integration of WASH into school systems. Political advocacy is also important in driving WASH actions and encouraging long-term ownership and commitment (Weber *et al.* 2019). The absence of clearly defined roles and accountability for school WASH provision between national and county governments undermines efforts to establish and sustain safe WASH services in schools (Hope and Tanui 2021). Adequate and reliable financing is critical to ensuring that WASH systems are sustainable, resilient, and consistently available, as financial investment is needed for the development, implementation, and ongoing maintenance of school WASH infrastructure.

Relevant stakeholders in WASH in schools, such as teachers, schoolchildren, and the community, need active participation and engagement in any health interventions or activities to enhance uptake, ownership, sustainability, and accountability.

Activities and outputs:

These activities include building safe water facilities, installing treatment tanks and water points, providing institutional latrines and hand washing stations, distributing hygiene kits, training teachers on WASH and hygiene practices, educating students about sanitation, supplying menstrual products, and establishing school WASH clubs. Other activities include solid waste management, the supply of

equipment and materials for waste management, the availability and supply of cleaning materials and disinfectants, and the cleaning of the school environment.

Activities and outputs focus on processes and, by themselves, do not represent actual change. The link between activities, output, outcomes and impacts is not always straightforward, as these elements may occur at different times and influence one another. The framework, therefore, includes a time component to show that activities, outcomes, and impacts develop progressively. Outcomes are the direct changes from WASH implementation, like better infrastructure or daily operations.

Outcomes:

Outcomes are influenced by adherence to the implementation methodology, contextual factors, available resources, infrastructure, the nature of service interventions, and the duration over which the tool is applied. In addition, policy and financial outcomes can play a key role in shaping operational practices and management structures. In the context of WASH in schools, the outcomes included active hygiene promotion activities in schools, availability of hand-washing facilities with soap, sufficient clean toilets, improved water quality, for example, on-site water treatment materials or facilities, improved water sources, safe water storage, and use of toilets and hand-washing facilities. Operational solid waste management system

Impacts:

These are defined as the long-term positive and negative effects of a developed intervention, they are may be direct or indirect, intended or unintended. This reflects the extent to which a project contributes to its broader developed objectives. Impacts are only visible after several years and are typically not fully achieved within a single project cycle. Therefore, there is a need to plan for impact, recognizing that the project will likely achieve outcomes. The impact of WASH in schools included reduced exposure to WASH-related diseases, improved health status of school children, improved school attendance and achievement.

1.8.4.1 The application of WASH FIT components to WASH in schools.

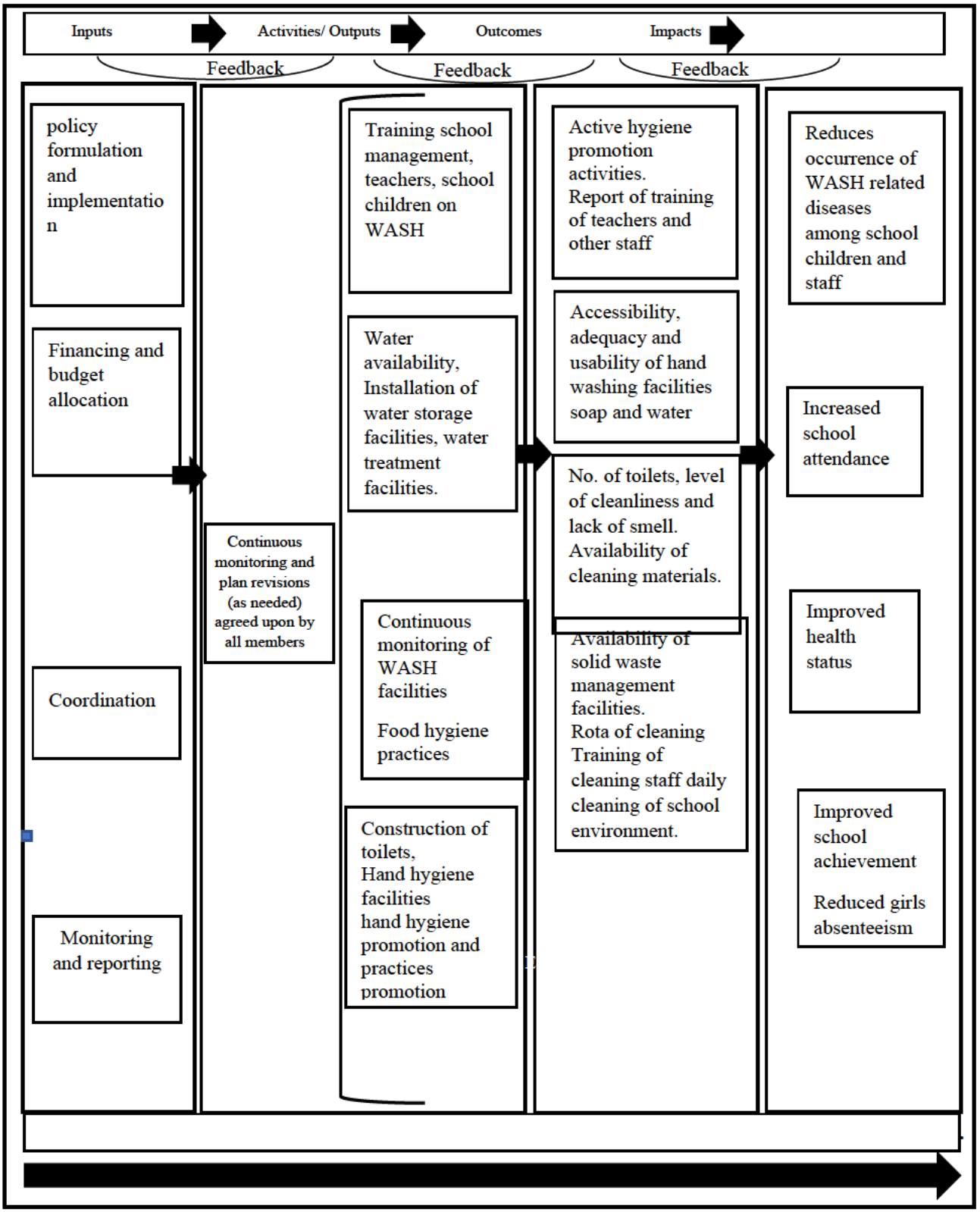


Figure 2: WASH conceptual evaluation framework for schools Ref: (Weber *et al.* 2019)

1.8.5 DEFINITION OF TERMS

Water interventions- Water intervention encompasses activities aimed at assessing water quality and infrastructure, as well as initiatives designed to establish new or enhance existing water supply or distribution systems. These interventions aim to limit exposure to water contamination by expanding piped water systems, developing boreholes, using hand pumps, trucking water, and protecting water sources. The goal is to improve drinking water quality at both the source and point of use.

Sanitation interventions- Refers to actions undertaken to evaluate sanitation facilities and to introduce, upgrade, or expand access to facilities that ensure safe management, disposal, and treatment of human excreta.

Hygiene interventions- involve supplying and utilizing materials like soap, hygiene kits, and hand washing stations, sinks, and facilities for menstrual hygiene. They also involve assessing and improving hygiene facilities and practices by promoting appropriate personal, food, and hygiene behaviors. In addition, these activities may include monitoring hygiene practices, adapting behavior change activities, applying specific delivery methods, theories, frameworks, or techniques for hygiene promotion, and eliminating or reducing intestinal parasites and parasitic infestations of the skin and scalp.

Short-term outcome evaluation- The experts' perspective on whether the developed interventions are feasible and acceptable for implementation in primary schools

1.9 SCOPE OF THE STUDY

This study evaluated WASH interventions in primary schools in Uasin Gishu County, Kenya. It aimed to inform effective strategies for managing infectious diseases within educational environments. Geographically, the study covered 51 primary schools selected from six sub-counties this included Turbo, Soy, Ainabkoi, Moiben, Kesses, and Kapseret representing both urban and rural settings.

The target population included mixed-gender primary schools with active candidate classes, and the study engaged a diverse group of respondents, including head teachers, teachers, school boards, and county officials, referred to as WASH experts. The research addressed several principal themes: the current status of WASH infrastructure and services, with attention to menstrual hygiene and disability inclusion;

policy and governance frameworks at both national and county levels; budgeting and allocation of resources for WASH initiatives; and the efficacy of systems for monitoring and evaluation.

The research used a multi-phase, mixed-methods case study approach. First, it conducted a scoping review of WASH interventions across low and middle-income nations. Then, empirical data was gathered from Uasin Gishu schools using surveys, focus groups, observations, and document analysis. A Delphi technique was then used to develop a context-specific WASH intervention, which was subsequently validated through expert workshops. The study's outcome was a three-pronged WASH intervention comprising a learner-centered menstrual health guide, an operational WASH Pyramid Framework for pandemic preparedness, and a strategic policy brief to institutionalize WASH practices in schools. Table 1 presents a summary of thesis format and publication plan.

Table 1: Summary of thesis format and publication plan

Chapter	**Manuscript title**	**Study objective covered**	**Research approaches**	**Contribution**
PHASE 1A **Chapter 2** **Journal article 1**	Water, Sanitation and Hygiene Interventions in Schools for Effective Pandemic Response in Low and Middle-Income Countries: A systematic scoping review	Objective 1: To map evidence of status of WASH interventions in primary schools in Low- and Middle-Income Countries	Scoping review guided by Arksey and O'Malley's framework	This paper presents a review of literature relating to School WASH interventions in LMIC
PHASE 1B **Chapter 4** **Manuscript 1**	Interventions of water sanitation and hygiene interventions towards effective response to infectious diseases. A case study of schools in Uasin Gishu, Kenya	**Objective 2:** To conduct a critical analysis of WASH interventions in public primary schools in Uasin Gishu County, Kenya.	Case study Quantitative Methods Qualitative Methods	Provides empirical evidence on the current status of WASH interventions in primary schools in Uasin Gishu County, Kenya.
Manuscript 2	The Resources of water sanitation and hygiene interventions towards effective response to infectious diseases.	**Objective 2:** To conduct a critical analysis of WASH interventions in public primary	Case study Quantitative Methods Qualitative	Provides empirical evidence on the input in schools for the implementation of WASH program in public primary

	A case study of schools in Uasin Gishu, Kenya	schools in Uasin Gishu County, Kenya.	Methods	schools in Uasin Gishu County
Manuscript 3	Document analysis of school health policies, guidelines and documents in Kenya: Water Sanitation and Hygiene (WASH) components	**Objective 2:** To conduct a critical analysis of WASH interventions in public primary schools in Uasin Gishu County, Kenya	Qualitative Methods	Provides the landscape, track changes and development over time of Kenya School Health Policies documents, guidelines and other related documents which contain components of Water, Sanitation, and Hygiene (WASH)
PHASE 2 **Chapter 5** **Manuscript 4**	Effective Implementation of WASH program in school: Experts consultation in Uasin Gishu County, Kenya	**Objective 3** To develop an appropriate intervention for WASH in public primary schools in Uasin Gishu County, Kenya.	Consensus method- Delphi technique Round 1 Delphi technique Round 2	Provide Key Informants views and opinions of stakeholders on how to make the School WASH program more effective
Chapter 6	Developed three-pronged WASH intervention strategy for pandemic preparedness and infection control for primary schools in Kenya	**Objective 3** To develop an appropriate intervention for WASH in public primary schools in Uasin Gishu County, Kenya	Semi-structured interview and Field notes taking	The three-pronged intervention strategy for WASH in schools creates a structured, holistic and sustainable approach to improving water, sanitation and hygiene systems.
PHASE 3 **Chapter 7**	Determining the feasibility and acceptability of the three-pronged WASH intervention strategy for pandemic preparedness and infection control in primary schools in Kenya	**Objective 4** To conduct Short-term outcome evaluation of the newly developed intervention by the experts involved in WASH in public primary schools in Uasin Gishu County, Kenya	Presentation of the intervention to the Sub-County Education directors, County officer in-charge of water department, County public works officer public health officers, quality assurance and standards officers,	Provide insight on establishment of a comprehensive, context-sensitive framework that strengthens the capacity of primary schools in Kenya to prevent, respond to, and recover from infectious disease outbreaks.

			constituency development funds officer, school head teachers and school board of Management	

1.10 CONCEPTUAL AND THEORETICAL INTEGRATION OF THESIS

Overview of the Chapter Integration Logic

This research presents a systematically integrated, multi-phase investigation of Water, Sanitation, and Hygiene (WASH) interventions in primary schools, with a specific focus on infectious disease prevention and pandemic preparedness in Uasin Gishu County, Kenya. The thesis is structured as a coherent, progressive inquiry, moving systematically from problem identification to evidence generation, intervention development, and finally validation of outcomes. The chapters are deliberately interlinked through a multi-phase mixed-methods design, anchored in a shared theoretical framework (WASH FIT, Logic Model, and Theory of Change).

The thesis is organized into eight chapters summarized as follows:

Problem conceptualization (Chapter 1) → Global evidence synthesis (Chapter 2) → Methodological operationalization (Chapter 3) → Contextual empirical analysis (Chapter 4) → Expert-driven intervention design (Chapter 5) → Development of practical WASH tools (Chapter 6) → Validation of feasibility and acceptability (Chapter 7) and overall contribution of the study to WASH in schools (Chapter 8)

Chapter 1- Conceptual and Theoretical Integration

Chapter 1 establishes the conceptual foundation of the thesis by situating school WASH within global public health priorities, including Sustainable Development Goal 6, the right to health, and post-COVID-19 school safety imperatives. The chapter clearly articulates the research problem, objectives, and questions, all of which are pursued consistently throughout the study.

A major integrative strength of the thesis is the early adoption and adaptation of the WASH FIT evaluation framework, combined with a Logic Model and Theory of Change. This integrated framework provides a unifying lens through which WASH inputs, activities, outputs, outcomes, and impacts are examined across all phases of the research. The framework ensures conceptual continuity from diagnosis to intervention design and evaluation, and it underpins the interpretation of findings in all subsequent chapters.

Chapter 2 – Global evidence as a foundation for contextual inquiry (Phase 1A)

Chapter 2 provides a published systematic scoping review of school-based WASH interventions in low- and middle-income countries and literature review, forming Phase 1A of the study. This chapter plays a critical integrative role by anchoring the thesis in global evidence and identifying persistent gaps in WASH infrastructure, hygiene practices, menstrual hygiene management, monitoring systems, and sustainability of interventions.

The review demonstrates that while numerous WASH interventions have been implemented globally, outcomes remain uneven and highly context-dependent. Importantly, it highlights the effectiveness of behavior-focused and low-cost interventions when combined with adequate infrastructure. These insights directly inform the design of the Kenyan case study (Phase 1B) and justify the need for context-specific, stakeholder-driven intervention development, which becomes the central focus of later chapters.

Chapter 3 - Methodological coherence across phases

Chapter 3 integrates the conceptual and empirical components of the thesis by detailing a multi-phase, mixed-methods case study design. Each research objective introduced in Chapter 1 is explicitly linked to a corresponding methodological phase, ensuring logical alignment across the thesis.

- The variability and gaps identified in global evidence (Chapter 2) justify the mixed-methods, multi-phase case study design adopted in Chapter 3.
- The need to move beyond descriptive evidence motivates:

- Empirical investigation in Kenyan schools (Phase 1B),
- Expert-driven intervention development (Phase 2),
- Outcome validation (Phase 3).

The chapter demonstrates methodological rigor using quantitative surveys, observations, qualitative focus group discussions, document analysis, Delphi consensus methods, and outcome evaluation workshops. Ethical considerations, trustworthiness, and validity are systematically addressed across phases. As such, chapter 3 functions as the methodological backbone of the thesis, enabling meaningful integration of findings from Chapters 4–7.

Chapter 4- Empirical finding of School WASH in Uasin Gishu County (Phase 1B)

Chapter 4 presents the empirical core of the thesis, addressing research objective 2 through a detailed assessment of WASH interventions in 51 primary schools. The findings confirm many of the global deficiencies identified in Chapter 2, including disparities between rural and urban schools, public and private institutions, and limited inclusion of learners with disabilities.

The chapter systematically applies the WASH FIT and Logic Model components by examining WASH inputs (infrastructure, resources, policies), activities (implementation practices, hygiene promotion), and immediate outcomes (facility functionality, behavioral practices). The WASH FIT framework introduced in Chapter 1 and operationalized in Chapter 3 is used in Chapter 4 to analyze:

- Inputs,
- Activities,
- Outputs,
- Short-term outcomes.

The results provide a robust evidence base demonstrating that existing school WASH systems in Uasin Gishu County are insufficient to support effective infectious disease prevention, thereby justifying the need for targeted intervention development.

Chapter 5 – Expert- led Translation of evidence into interventions (Phase 2)

Chapter 5 marks a pivotal transition from diagnosis to solution. Using the Delphi technique, the chapter integrates empirical findings (Chapter 4), global evidence (Chapter 2), and policy context (Chapter 1) through structured expert consensus building.

The Delphi technique uses the logic model structure to determine:

- Who should act (inputs),
- What should be done (activities),
- How implementation should occur (processes).

The Delphi process ensures that the proposed interventions are technically sound, contextually relevant, and stakeholder-endorsed. It addresses key questions concerning who should be involved in school WASH implementation, what elements should be prioritized, and how interventions should be operationalized. This chapter strengthens the thesis's applied contribution by grounding intervention design in both evidence and local expertise.

Chapters 6 – Theoretical framework synthesis into a Three-Pronged WASH Intervention Strategy

Chapter 6 represents the conceptual and practical synthesis of the thesis. Drawing on findings from all preceding chapters, it presents a three-pronged WASH intervention strategy comprising:

1. A learner-centered menstrual health informational guide, addressing gender-specific needs and school attendance;
2. An operational WASH Pyramid Framework, designed to strengthen pandemic preparedness and infection control through layered, system-based actions;
3. A strategic policy brief, aimed at institutionalizing WASH improvements within school health systems.

Each intervention component is explicitly aligned with the WASH FIT framework and addresses empirically identified gaps. Every component of the three-pronged intervention can be traced back to:

Expert inputs (Chapter 5), Identified gaps (Chapter 4), Global evidence (Chapter 2).Chapter 6 consolidates theory, data, and expert input into a holistic intervention model that is both scalable and context-appropriate.

Chapter 7 – Validation and Short-Term Outcome Evaluation (Phase 3)

Chapter 7 tests the assumptions underpinning Chapter 6. The same stakeholders involved in development (Phase 2) validate the intervention as end-users, strengthening credibility. Chapter 7 completes the research cycle by evaluating the feasibility and acceptability of the developed intervention strategy through expert workshops.

This phase provides evidence that the interventions are realistic and acceptable to key stakeholders, including education, health, and WASH professionals. It provides empirical confirmation that the developed interventions are contextually appropriate and implementable

The findings align with the outcome level of the Logic Model, demonstrating readiness for implementation and reinforcing the plausibility of the Theory of Change introduced in Chapter 1. Chapter 7 therefore closes the loop between problem identification, intervention development, and practical validation.

Chapter 8 represents the culmination of a multi-phase, mixed-methods investigation, synthesizing conceptual, empirical, and applied contributions of the study. It integrates outputs from:

- Phase 1A (Global evidence synthesis)
- Phase 1B (Empirical assessment in schools)
- Phase 2 (Delphi-driven intervention development)
- Phase 3 (Validation and feasibility assessment)

This chapter aligns with the thesis progression from problem identification → evidence generation → intervention design → validation → contribution, as articulated in the integration framework of the study

Connecting text

Chapter one introduced the study, outlined the problem statement, research objectives, significance and justification, theoretical framework applied and a summary of how each chapter of the study is integrated. The next chapter is chapter 2, focused on the literature review and systematic scoping review research paper on water, sanitation, and hygiene interventions in schools for effective pandemic response in low- and middle-income countries published in the Journal of Water, Sanitation and Hygiene for Development. Volume 15, Issue 9, 1 September 2025.

2.0 LITERATURE REVIEW

2.1 Global Perspectives on School WASH

The global evidence base on school-based water, sanitation, and hygiene (WASH) interventions remains fragmented, and there is currently limited systematic evaluation across diverse settings (McMichael, 2019). However, results from existing synthesis studies clearly show that WASH interventions can improve health outcomes, though effect sizes are highly context and implementation dependent.

A large meta-analysis by Wolf *et al.* (2022) found that combined water, sanitation, and hand-washing interventions reduce diarrhea and related infectious diseases among children in low-resource settings. However, the authors note some significant variation in effect sizes, driven primarily by baseline infrastructure, adherence levels, and contextual implementation factors.

However, although progress has been made, there are still gaps in world's WASH coverage. According to the WHO/UNICEF Joint Monitoring Program (WHO/UNICEF JMP, 2024), 447 million children lack basic drinking water, 427 million lack basic sanitation, and 646 million lack basic hygiene services in schools. Menstrual health provision remains poor, with fewer than one-third of schools offering menstrual health education or appropriate disposal facilities. These statistics highlight the continued disparities in achieving Sustainable Development Goal (SDG) 6 in education settings (UNICEF & WHO, 2024; WHO, 2024; UNICEF, 2024)

Another limitation in the global literature is methodological flaws. In a review of 69 studies, Dibaba, Alemu, and Debela (2024) found that there was limited gender-disaggregated analysis and a lack of attention to outcomes of menstrual hygiene management (MHM), particularly in relation to school attendance among girls. There is a need for more longitudinal studies to provide more evidence for behavioral and peer-led interventions that were found to be cost-effective in the long term. Likewise, Seroney, Mchunu and Magak (2025) advance the potential of integrated and behavioral methods, pointing out that there is weak causal evidence that hinders the translation of policy. Taken together, these gaps limit the growth of gender-responsive and context-specific WASH policies.

2.2 School WASH in Low- and Middle-Income Countries

School WASH program is constrained by structural and institutional challenges, such as inadequate financing, coordination issues, and monitoring capabilities particularly in low- and middle-income countries (LMICs) (UNICEF, 2024). While 8,677 schools were supported in 2024 with basic WASH, the coverage is still significantly short of universal coverage targets set for SDG 2030, meaning that there are still significant gaps to address. These challenges to implementation only continue to make it difficult to achieve equitable access to safe and sustainable school environments.

Inadequate school WASH services are especially visible in the African region, including the absence of water, sanitation and hygiene facilities, which remains a factor to continue impacting child health, educational participation and gender equality. Rural schools are more affected as many have unimproved sources of water, overcrowded latrines and inadequate handwashing facilities (WHO/UNICEF JMP, 2024). Unfavorable WASH conditions have been linked to the risk of infectious diseases, absenteeism, and poor concentration among pupils, especially during menstruation, for adolescent girls (UNESCO, 2023). These challenges have been considered and a regional program, for instance the African Union's Agenda 2063 and UNICEF's WASH strategies, have made school WASH a key part of child development and educational attainment. However, progress is not consistent because of low investment, high population growth and poor maintenance systems in many countries.

There are also persisting inequalities within sub-Saharan Africa. The WHO/UNICEF JMP 2024 estimates shows that only 12% of schools distribute maternal materials and only 11% have good menstrual hygiene facilities. The results show significant gaps in gender-inclusive school infrastructure and the importance of more targeted and equitable interventions to better serve under-resourced schools. The poor availability of menstrual hygiene services is still an impact of school absenteeism, discomfort and lower participation of adolescent girls, which results in further education and gender inequalities.

Climate variability, water insecurity and infrastructure inequalities between urban and rural areas also exacerbate school WASH challenges in East and Eastern Africa. Despite the progress made in the availability of water and sanitation features in many schools, evidence from Kenya, Ethiopia, Tanzania, and Uganda indicates that many schools do not have permanent access to water, and sanitation is limited,

which is hindering the effective management of menstruation and is having negative impacts on girls' education (Sommer *et al.* 2021; UNICEF Eastern and Southern Africa, 2024). Also, based on the regional assessments, droughts, lack of funding and insufficient technical capacity to maintain infrastructures have often caused disruptions in service delivery, especially for WASH. Despite these barriers, community-based approaches, student-led hygiene promotion initiatives, and incorporation of WASH into school health policies have shown promise of enhancing sustainability and behavioral outcomes throughout the region (UNICEF ESARO, 2024).

The effectiveness of school WASH programs is also very context specific and is evident in intervention studies. One cluster-randomized controlled trial in Addis Ababa reported that school-based WASH interventions were successful in decreasing respiratory illness by 16%, but not the incidence of diarrheal diseases or school attendance (Opondo *et al.* 2024). The results indicate that better health improvements do not necessarily lead to tangible education outcomes, underscoring the complexity of the linkages between WASH and education.

Abdullahi *et al.* (2025) also identified several enablers of successful WASH implementation in the Horn of Africa, such as funding, multi-level accountability, technical feasibility, and student engagement. Yet, salient challenges like weak sanitation systems and maintenance practices are still working against sustainability. The overall insights from the findings suggest that the WASH interventions works in theory, but in practice are heavily determined by the institutional, environmental and system-level factors.

2.3 School WASH in Kenya: Policy, Implementation, and Evidence

Despite many years of research into school WASH in Kenya, there are still notable barriers between policy and practice. The Kenya WASH in Schools Strategy 2024–2029 has been identified to have key constraints including weak policy dissemination, inadequate financing, and competing sectoral priorities (Ministry of Education, Ministry of Health and Ministry of Water, Sanitation and Irrigation, 2024). The strategy also emphasizes that previous policy frameworks on school health and menstrual hygiene management had poor implementation at school level. Seroney, Magak and Mchunu (2026) report that there was consensus at sub-national level in Uasin Gishu County on the priority system strengthening interventions, which include dedicated budget lines, improved menstrual hygiene facilities, improved

monitoring systems, and curriculum integration. This is indicative of a broader understanding that sustainability of WASH is dependent on institutionalization and isolated interventions.

There are consistent empirical pieces of evidence to show that there are gaps in service delivery in Kenyan schools. Ombogo *et al.* (2023) conducted a study on the prevalence of school absenteeism among schoolgirls due to menstruation in Kisumu County and reported that 65.9% of schoolgirls missed school during periods due to inadequate sanitary products and lack of privacy. Kirira *et al.* (2023) revealed that 66.7% of the rural schools had no reliable water supply and there was a significant difference between the arid and semi-arid areas. Similarly, Kanyingi, Mbugua and Waudo (2023) reported 70% of the schools had latrines but only 35% of the schools had latrines that met minimum standards in terms of pupil-to-latrine ratios.

There is potential evidence for impacts from interventions, but these are context dependent. Austrian *et al.* (2021) demonstrated that providing sanitary pads significantly improved school attendance among girls, particularly when combined with puberty education. However, taken together with broader findings, this indicates that isolated inputs are insufficient without complementary infrastructure, policy enforcement, and behavioral support systems.

2.4 Theoretical or Conceptual Framing of School WASH Implementation

The theoretical or conceptual frame of school WASH implementation adopts a systems-strengthening perspective, which understands the implementation of School WASH as a multidimensional process shaped by interdependent institutional, infrastructural, financial, behavioral, and governance mechanisms. Systems approaches consider WASH interventions as one part of a coordinated whole, focusing on policy integration, stakeholder coordination, accountability mechanisms, financing mechanisms and community participation in the sustainability of the interventions (WHO, 2010). This is especially important in the context of case study research as it provides detailed insights into the role of contextual and institutional factors in the implementation and sustainability of school WASH programs in certain contexts. Accordingly, this study adopts a systems-oriented lens to explore the implementation experiences, challenges, and sustainability considerations shaping school WASH interventions in the Kenyan context.

Conclusion

In general, the literature show that school WASH interventions have considerable potential to improve child health, hygiene behavior, gender balance, and participation in education. But the global, regional, and Kenyan evidence suggests that there is a wide range of implementation outcomes, reflecting the interplay of infrastructural, institutional, financial, and contextual factors. There are still recurring problems of poor financing, lack of policy implementation, poor menstrual hygiene management, and poor maintenance systems that continue to compromise the sustainability and effectiveness of interventions, especially in low-resource and rural schools. Importantly, there is a wealth of evidence documenting the benefits and limitations of school WASH interventions, but less on how they are implemented in specific settings, how barriers at the systems level affect implementation, and how the benefits of school WASH interventions can be sustained at sub-national levels. There is little research on the development and evaluation of integrated, context-responsive approaches in actual school contexts. The gaps identified provide an opportunity to investigate how to develop and test context-specific, system-strengthening interventions in primary schools to foster sustainability and effectiveness of school WASH, while analyzing the status and challenges of school WASH interventions.

2.5 PUBLICATION ONE: WATER SANITATION AND HYGIENE IN SCHOOLS FOR EFFECTIVE PANDEMIC RESPONSE IN LOW - AND MIDDLE-INCOME COUNTRIES: A SYSTEMATIC SCOPING REVIEW

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Review Paper

Water, sanitation, and hygiene interventions in schools for effective pandemic response in low- and middle-income countries: a systematic scoping review

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ABSTRACT

In low- and middle-income countries, inadequate water, sanitation, and hygiene (WASH) services in schools pose significant challenges to controlling infectious disease outbreaks. The aim of conducting this review is to assess school WASH interventions to give guidance in the formulation of WASH improvement strategies in schools. A systematic review of peer-reviewed articles that reported on WASH interventions in primary schools was conducted. Five databases were systematically searched. Inclusion and exclusion criteria yielded 69 studies reporting on WASH interventions being included. The review is organized based on four school WASH intervention categories: water, sanitation, hygiene, and a combination of water, sanitation, and hygiene. Behavioral change therapy (BCT), peer education based on the Health Believe Model, introduction and promotion of hand hygiene curriculum, group handwashing station, and better menstrual management for schoolgirls are long-term and cost-effective school-based interventions that can contribute to better WASH outcomes in schools. The review recommends the adoption of cost-effective interventions and other strategies by governments and other stakeholders. Further research needs to be conducted on the long-term impact of school-based behavioral change interventions and on practical, acceptable, and cost-effective disease prevention strategies for school children.

Key words: hygiene, interventions, sanitation, schools, WASH, water

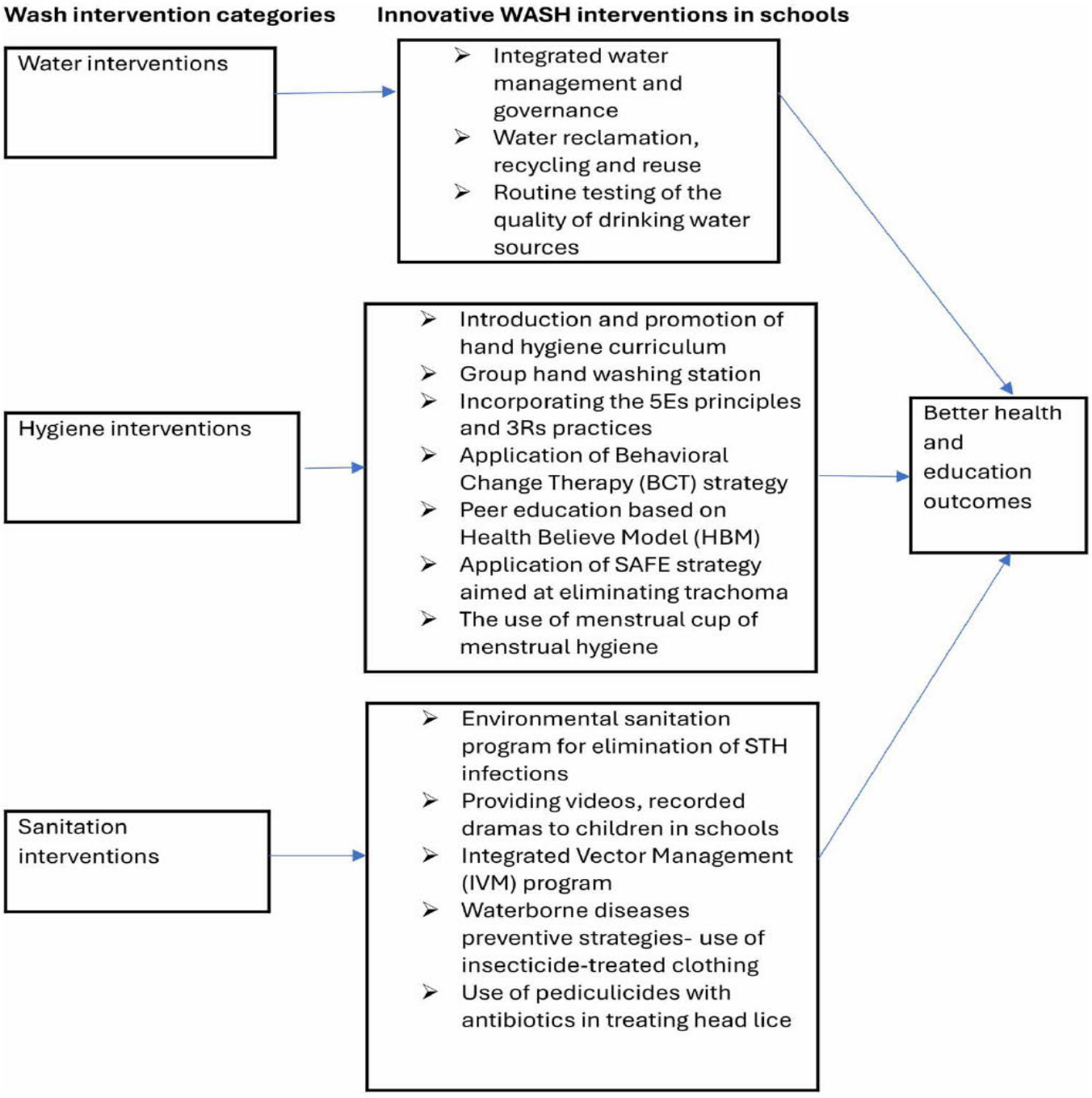
HIGHLIGHTS

- An in-depth review of articles reporting on Water Sanitation and Hygiene interventions in primary schools.
- Water Sanitation and Hygiene interventions discussed based on four categories.
- Long-term and cost-effective school-based interventions for better Water, Sanitation and Hygiene outcomes.

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GRAPHICAL ABSTRACT



ABBREVIATIONS

CINAHL Cumulative Index to Nursing and Allied Health Literature
JBI Joanna Briggs Institute

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MMAT	Mixed Methods Appraisal Tool
PRISMA	ScR-preferred reporting items for systematic reviews and meta-analyses for scoping reviews
SDGs	sustainable development goals
UNGA	United Nations General Assembly (UNGA)
UNICEF	United Nations Children's Fund
WASH	water, sanitation, and hygiene
WHO	World Health Organization

INTRODUCTION

Schools are critical for the control and spread of many infectious diseases, including COVID-19, depending on their access to and quality of water, sanitation, and hygiene (WASH) and the implementation of WASH interventions. Water, sanitation, and hygiene are fundamental human requirements and have an impact on ensuring basic rights to decent standards of living and health (Toleubekov *et al.* 2022). Though adequate WASH access is the right of every child as stated in the Right of the Child Convention of 1989 (Sangra *et al.* 2022) and is vital for the complete healthy growth and development of children from all around the world (Girmay *et al.* 2023), access to WASH in schools remains limited in developing countries. This is despite continued national and international efforts in providing WASH services and rolling out interventions in schools to improve WASH services (Anthonj *et al.* 2021).

WASH interventions and improving WASH practices have the potential to reduce the prevalence of diseases such as schistosomiasis, cholera, diarrhea, polio, and typhoid, which are prevalent in most sub-Saharan African countries (Tseole *et al.* 2022).

Lack of current data on school WASH infrastructure and interventions in the light of the recent COVID-19 pandemic puts millions of school-going children at risk because they may not have access to water, basic hygiene, and sanitation facilities in schools. The aim of the review is to assess the status of school WASH interventions. The objectives of the review include the following:

1. To extract and review previous studies on water, sanitation, and hygiene interventions implemented in schools in low- and middle-income countries.
2. To determine which WASH interventions implemented can be effective in responding to disease pandemics in schools in low- and middle-income countries.

The studies reviewed focused on different activities and ways of improving WASH in schools. Some of the interventions reviewed involved improving WASH infrastructure like installation and/or improvement of water, sanitation, and handwashing facilities, water purification, provision of health education and health promotion of school children and teachers on handwashing, menstrual hygiene, soil-transmitted helminths (STHs), implementation on the use of behavior change therapy in school WASH, laboratory parasitology screening of children with intestinal parasites, screening or presence of trachoma using different laboratory test arrays, deworming, and testing of effectiveness of some anthelminthics on treating specific STHs.

MATERIALS AND METHODS

Search strategy

Review and analysis of the published peer-reviewed journal articles reporting on water, sanitation, and hygiene interventions in schools in low- and middle-income countries were conducted in adherence to the Joanna Briggs Institute (JBI)-endorsed Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews (PRISMA-ScR) checklist (Tricco *et al.* 2018). On 10 October 2021, 12 October 2021, and 18 October 2021, the following databases were systematically searched, adapting search terms according to the requirements of each database: Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, Academic Search Complete, Scopus, and Google Scholar. The search words were divided into key terms as indicated in Table 1.

Keywords were combined using Boolean operators AND and OR, while search terms within the keywords were combined using AND and OR operators.

In CINAHL, searches were conducted in Text Word (TX) and Boolean operators AND and OR. The total number of articles retrieved from the database was 133.

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Table 1 | Keywords used in search strategy

Keyword 1	Keyword 2	Keyword 3	Keyword 4	Keyword 5	Keyword 6	Keyword 7
Water	Sanitation	Hygiene	Interventions	Schools	Communicable diseases	Developing countries
Water quality	Sanitation and hygiene	Sanitation and hygiene	Systems	Primary schools	Infectious diseases	Low-income countries
Water availability	Water and sanitation		Infrastructure	Elementary schools		Third world countries
Water supply	Water sanitation and hygiene					
Water infrastructure	School sanitation					
Water sanitation and hygiene						
Water sanitation						

In PubMed, searches were conducted in Full Text (TW), and Boolean operators AND and OR were also used to combine the search. Medical Subject Headings (MESH) were included in searches conducted. The total number of articles retrieved was 30.

In Academic Search Complete, the database search was conducted using Boolean operators AND and OR. All searches were retrieved in Full Text (TX). The total number of articles retrieved in this database was 582. All searches conducted in SCOPUS utilized the AND and OR operators with a total of 439 articles being retrieved from the database. In Google Scholar, searches were conducted using Boolean operators AND and OR. A total of 94 articles were retrieved from Google Scholar database. The detailed search strategies applied for different databases are displayed in Table 2.

Before the screening of titles and abstracts, the proposed scoping review was registered on OSF (Open Science Framework) and can be accessed via the following link: https://osf.io/rytp9.

Selection criteria

Studies were eligible for inclusion if they were published in peer-reviewed journals in English and other languages that were relevant to the study and were published between January 2000 and September 2021. The articles needed to focus on WASH and communicable diseases or disease outbreaks that are strictly conducted in schools. There was no methodological restriction in the identification of the articles to be included in the study; any article that presented on WASH in schools in low- and middle-income countries regardless of its research design was included. However, articles that were on WASH and communicable diseases conducted outside schools were excluded from the selection criteria.

Quality assessment

Quality appraisal of all included articles in the review was conducted using the Mixed Methods Appraisal Tool (MMAT) version 2018. MMAT is used as a tool to appraise the quality of different study designs. Critical appraisal of the articles was carried out by two independent reviewers, and the indicators used for quality scores included (1) a clear definition of the study objective and aim, (2) study design appropriate for stated aims, (3) justified sample size, (4) targeted population defined, (5) risk factor and outcome variables measured, (6) methods clearly described, (7) study results described, (8) discussions and conclusions justified, (9) study limitations discussed, and (10) ethical approval for the study attained. For each study, we used scores ranging from 0 to 10, where 0–4 = 'low' quality, 5–7 = 'moderate' quality and 8–10 = 'high' quality. Most of the articles selected scored moderate. While no study scored 'low', 57 articles scored 'moderate' and 10 articles scored 'high'.

Calculation of the overall percentage quality score was done. The scores were graded, ranging from ≤50%, which was regarded as low quality; 51–75%, which was average quality; and 76–100%, which was regarded as high quality.

Data management and extraction

All the articles were saved in a folder in EndNote 20 and were exported to Rayyan online software for screening. The review process was conducted in three stages of screening. In the first stage, the principal investigator (G. S.) screened the titles of the articles retrieved from the database searches. All eligible articles were exported into the Endnote 20

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Table 2 | Databases search strategy

Keywords search	Date of search	Search engine used	Number of publications retrieved
TX (Water OR Sanitation OR Hygiene OR 'water sanitation' OR WASH OR 'water sanitation and hygiene' OR 'water supply' OR 'water quality' OR 'water infrastructure' OR 'water availability' OR 'WASH systems' OR 'water interventions') AND TX ('infectious diseases' OR 'communicable diseases') AND TX ('primary schools' or 'elementary schools') AND TX ('developing countries' or 'third world countries' or 'low income countries') Water OR Sanitation OR Hygiene OR 'water sanitation' OR WASH OR 'water sanitation and hygiene' OR 'water supply' OR 'water quality' OR 'water infrastructure' OR 'water availability' OR 'WASH systems' OR 'water interventions' 'infectious diseases' OR 'communicable diseases' 'primary schools' or 'elementary schools' 'developing countries' or 'third world countries' or 'low income countries'	12 October 2021	CINAHL	133
(Water[tw] OR Sanitation[tw] OR Hygiene[tw] OR 'Sanitation and hygiene"[tw] OR 'water sanitation"[tw] OR WASH[tw] OR 'water sanitation and hygiene"[tw] OR 'water supply"[tw] OR 'water quality"[tw] OR 'water infrastructure"[tw] OR 'water availability"[tw] OR 'WASH systems"[tw] OR 'Water"[Mesh] OR 'Water Quality"[Mesh] OR 'Hygiene"[Mesh] OR 'Sanitation"[Mesh] OR 'school sanitation"[tw]) AND ('infectious disease*"[tw] OR 'Communicable Disease*"[tw] OR 'Communicable Diseases"[Mesh])) AND ('Primary school*"[tw] OR 'elementary school*"[tw] OR school*[tw] OR 'Schools"[Mesh])) AND ('developing countr*"[Text Word] OR 'third world"[Text Word] OR 'low income countr*"[Text Word] OR 'Developing Countries"[Mesh]) Filters: from 2000/1/1 to 2021/9/30	10 October 2021	PubMed	30
TX (Water OR Sanitation OR Hygiene OR 'water sanitation' OR WASH OR 'water sanitation and hygiene' OR 'water supply' OR 'water quality' OR 'water infrastructure' OR 'water availability' OR 'WASH systems' OR 'water interventions') AND TX ('infectious diseases' OR 'communicable diseases') AND TX ('primary schools' or 'elementary schools') AND TX 'developing countries' or 'third world countries' or 'low income countries')	10 October 2021	Academic Search Complete	582
(ALL (*water* OR *sanitation* OR *hygiene* OR *(Shrestha et al.)* OR *wash* OR *(Shrestha et al.)* OR *{water supply}* OR *{water quality}* OR *{water infrastructure}* OR *{water availability}* OR *{WASH systems}* OR *{water interventions}*) AND ALL (*{infectious diseases}* OR *{communicable diseases}*) AND ALL (*{primary schools}* OR *{elementary schools}*) AND ALL (*{developing countries}* OR *{third world countries}* OR *{low income countries}*)) AND PUBYEAR >*1999* AND (EXCLUDE (DOCTYPE, '*bk*') OR EXCLUDE (DOCTYPE, '*ch*'))	12 October 2021	SCOPUS	439
(water OR sanitation OR Hygiene OR WASH) AND ('primary school' OR 'elementary school') AND ('developing countries' OR 'low income countries' OR 'third world')	18 October 2021	Google Scholar	94

library (Gotschall 2021), and duplicates of the articles were removed. All identified articles from the first screening were collected and exported to Rayyan free web tool for the second screening; this was conducted by two independent trained reviewers (G. S. and V. A.) who screened abstracts in parallel. Any disagreement in screening between the two reviewers was resolved by discussion and consensus (G. S. and V. A.). The third screening involved screening of full-text articles that became eligible following the abstract screening; this screening was also done by two independent trained reviewers (G. S. and V. A.). Discrepancies in reviewers' responses following full article screening were resolved by a third screener (P. P.).

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A data extraction table is presented in the Supplementary material, Table S1 that captures the following information: (i) the author, year of publication, (ii) county of publication, (iii) study design, (iv) the sample size, (v) intervention category, (vi) the intervention/exposure, (vii) key findings, and (viii) and conclusion.

The interventions reviewed in the scoping review have been categorized into three categories: water interventions, sanitation intervention, and hygiene interventions as illustrated in Table 3.

RESULTS

The initial search terms identified 1,324 publications. The secondary screening based on the title identified 1,094 articles with a potential focus on WASH in schools' interventions in low- and middle-income countries. Two hundred and fifty-eight full-text articles were assessed for eligibility, and 69 articles met the inclusion criteria following screening by abstract and then full text. A summary of the screening process is depicted in the PRISMA extension flow diagram (Figure 1).

Characteristics of the included studies

All included papers were published in English. All peer-reviewed papers selected were full research articles and from systematic reviews conducted on schools' WASH interventions in middle and low-income countries. The studies reviewed were carried out in 35 different countries, most of which were carried out in sub-Saharan Africa, representing 41% ($n = 16$) of the articles. A total of 23% ($n = 9$) of the articles were carried out in Asia, 10% ($n = 4$) in European countries, 7.7% ($n = 3$) of the articles in South America, 5.1% ($n = 2$) in North America, and 2.5% ($n = 1$) conducted in Australia. A total of 10% ($n = 4$) of the studies were conducted in multiple locations (countries), and 10% ($n = 4$) of articles from review papers did not record a specific region of publication but were conducted in sub-Saharan African countries, resource-limited settings, and developing countries.

WASH in schools was more frequently assessed in Ethiopia, Uganda, and Kenya: $n = 6$, $n = 4$, and $n = 4$, respectively. South Africa and Nigeria recorded three articles each. Iran and Thailand from Asia also had three articles each. The countries where studies were conducted and the frequency of the studies per country are represented in Figure 2.

The 69 studies included in the scoping review comprised a wide variety of study designs, 46.2% ($n = 32$) studies were quantitative studies, 36.2% ($n = 25$) studies were randomized control trial, 14.4% ($n = 10$) studies were systematic and scoping review papers, 1.4% ($n = 1$) studies were nonrandom control trials studies, and 1.4% ($n = 1$) of the study was intervention research design.

From all the articles of school WASH interventions studies, 47.8% ($n = 33$) articles were on hygiene interventions, 30.4% ($n = 21$) articles were on sanitation interventions, 4.3% ($n = 3$) articles were on water interventions, and finally, 18.8% ($n = 13$) articles were on combined water sanitation and hygiene interventions in schools.

Table 3 | Categories of Water, Sanitation and Hygiene interventions included in the review

WASH intervention category	Definition
Water interventions	Any intervention to assess water quality and facilities, to provide a new and/or improved water supply or distribution system, or both, the intervention that would reduce directly and indirectly exposure to water contamination (e.g. installation and extension of piped water supply, boreholes, hand pumps, water trucking or tankers, and protection of water resources) Intentions to improve quality of drinking water at the source or point of use
Sanitation interventions	Any intervention to assess sanitation facilities, introduce, improve, or expand the coverage of sanitary facilities for safe management, disposal, and treatment of excreta
Hygiene interventions	Any intervention that provides hygiene materials or use of hygiene materials (e.g., soap, hygiene kits, handwashing stands/ stations, sinks, menstrual hygiene and other facilities) Any intervention to assess hygiene facilities, improve hygiene, including: (1) Promotion of hygiene behaviors, norms, or practices surrounding personal, food, and hand hygiene (2) Assessment and monitoring of hygiene behaviors, norms or practices, including adaptation of activities Any named method of delivery of hygiene promotion Any named theory, framework, or technique for hygiene promotion Any interventions to reduce and eliminate intestinal parasites, contact diseases/parasitic infestations of the skin and the scalp

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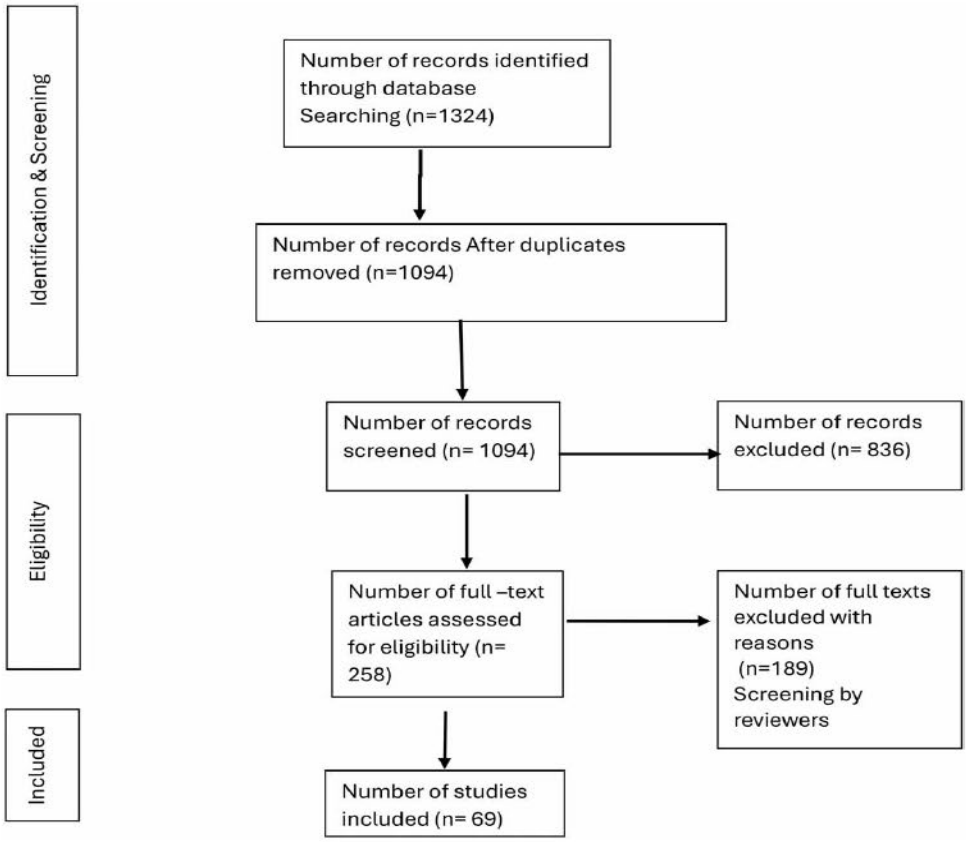


Figure 1 | PRISMA extension flow diagram showing procedure for article selection for scoping literature review on water, sanitation, and hygiene in schools in low- and middle-income countries.

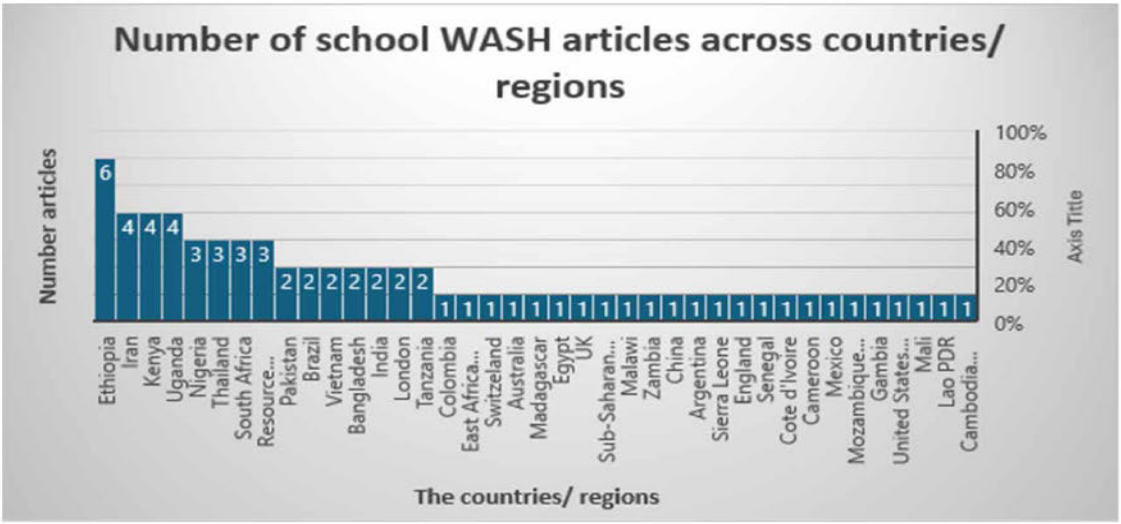


Figure 2 | Number of studies across countries.

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Water interventions component of WASH in schools

Of the $n = 69$ articles reported from the scoping review, only $n = 3$ articles reported on water intervention. An intervention to screen school water sources for the presence of microbes and the assessment of different ways used by primary schools in Pakistan to improve their water quality and safety for use revealed that the sources of water at school were mainly groundwater or dug-well (62%) and surface water supplied through pipes and water cans/plastic bottles (38%). Year-round availability of water from the main source was reported by the one-third of schools (33.4%). Across all schools, 49% of the drinking water samples were contaminated with *Escherichia coli*, 54% with *Salmonella* spp., 49% with *Vibrio cholerae*, and 63% with *Shigella* (Ahmed *et al.* 2020).

A cross-sectional study that was conducted to analyze water quality in 154 schools in Hanoi Vietnam revealed that schools' water did not meet the allowable limits of the national standard due to pH (3.9%), turbidity (0.6%), nitrite (3.2%), permanganate (6.5%), and ammonium (5.8%). The water system was also contaminated by coliform (9.7%) and/or *E. coli* (7.8%) (Hung *et al.* 2020).

In a systematic review conducted by Jasper *et al.* (2012), the analysis of the studies provided evidence for an increase in water intake with increased provision of water and increased access to water facilities and that there was an increase in absenteeism from schools in developing countries during menses due to inadequate sanitation facilities. The review concluded that ensuring ready access to safe drinking water and hygienic toilets that offer privacy to users has great potential to beneficially impact children's health.

Sanitation interventions components of WASH in schools

Many interventions in the sanitation category included interventions on conducting baseline assessment on worm infestations followed by treatment with specific anthelminthics and health education on worm infestation and its prevention. Some of the studies went ahead to conduct a posttreatment screening for worm infestations to validate the effectiveness of treatment. Saathoff *et al.* (2004) and Senghor *et al.* (2015) tested the effectiveness of praziquantel (PZQ) in the treatment of *Schistosoma haematobium*. PZQ treatment was highly efficacious at 3 weeks after treatment when judged by the egg reduction rate (95.3%) and the cure rate of heavy infections (94.1%). The apparent overall cure rate 3 weeks after treatment of 57.9% was much lower, but improved to 80.7% at 41 weeks after treatment. Re-infection with *S. haematobium* was low.

A randomized control trial study in Nigeria conducted a baseline screening of pupils with STH through stool examination and baseline health knowledge about worms, and thereafter conducted health education on worms and mass drug administration (MDA). Assessment of stool and urine was later done to ascertain the infestation levels of worms in the pupils. After treatment, the overall prevalence at that period was 13.8%, which was significantly lower than the prevalence at baseline (73.2%). A new health education board game in worm and ladders was introduced to improve the knowledge, attitudes, and practices of school-aged children (SAC) about transmission, prevention, and control of STH infections (Bassey *et al.* 2020).

Freudenthal *et al.* (2006) and Favre *et al.* (2015) conducted school-based and community-based intervention by testing the effectiveness of PZQ and mebendazole in treating STHs and *Schistosoma mansoni*. This was followed by health education on worm infestation through videos, recorded drama, and household sanitation survey. In school-based and a community-based scheme, coverage of diagnosis and treatment was satisfactory (>75%). A cross-sectional study conducted by Hailu *et al.* (2020) assessed the use of a single dose of ivermectin in treating uncomplicated chronic strongyloidiasis in school children in Ethiopia. Of the total 92 *S. stercoralis*-infected students who took ivermectin treatment, 87 were negative, with a cure rate of 94.6%. No side effects of ivermectin were observed.

A baseline survey was done on two adjacent schools in Cote D'Ivoire, one being an intervention school and the other a control school for worm infestation, measurement of hemoglobin levels, and anthropometric measurement. Children were then dewormed with 5-month follow-up. Deworming showed no effect on hemoglobin levels and anemia, but children with moderate- to heavy-intensity *Schistosoma* infection at baseline gained weight more pronouncedly than noninfected children. Children with STH or *Schistosoma* infection at baseline performed significantly better in the sustained attention test than their noninfected counterparts at the 5-month follow-up (Hürlimann *et al.* 2014). Health professionals and community health workers in Ethiopia participated in a 1-month MDA to deworm SAC in schools and the community: 3,378 households and 5,679 SAC. Thereafter, a survey was conducted to validate the number of SAC who were treated in the MDA. The results indicated that the treatment coverage of PZQ against schistosomiasis was 4,286 (75.5%) (Chisha *et al.* 2020).

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A few interventions in the sanitation category focus on areas other than worm infestation interventions. A study was conducted on the assessment of building and indoor environmental quality in Nigerian primary schools. The results showed that only one school had functioning toilets, whereas the other four schools were missing appropriate toilet and handwashing facilities. All five schools employed natural ventilation by leaving windows and doors open (Toyinbo *et al.* 2019). A cross-sectional study on 300 pupils in six primary schools in Cameroon to screen the pupils for malaria using standard parasitological methods showed that 79 (15.3%) persons positive for *Plasmodium* were all asymptomatic; 71 (13.8%) cases had *Plasmodium falciparum*, and 8 (1.5%) had *Plasmodium malariae*; there was a significant negative correlation between age and infection ($r = -0.82$). The parasite density ranged from 60 to 22,590 (Payne *et al.* 2013). A randomized control trial by Tozan *et al.* (2014) was conducted on cost-effectiveness analysis on the use of insecticide-treated school uniforms for prevention of dengue in schoolchildren in Thailand; the results indicated an average dengue incidence rate of 5.8% per year in SAC; the intervention was cost-effective in a variety of scenarios when the intervention cost per child was $5.3 or less; and the intervention effectiveness was 50% or higher.

Hygiene interventions component of WASH in schools

Thirty-three percent of the articles ($n = 33$) assessed or implemented hygiene interventions in schools. Twelve studies ($n = 12$) highlighted the importance of frequent meticulous handwashing with soap and water as an effective and cost-effective public health measure to reduce respiratory and diarrheal diseases in school children (Pickering *et al.* 2013; Mangklakeree *et al.* 2014; Watson *et al.* 2017; Burns *et al.* 2018). Following a cross-sectional study conducted in Kampala and Mukono in Uganda after a school intervention hygiene project, Musoke *et al.* (2018) concluded that health clubs and talking messages are beneficial strategies to promoting sanitation and hygiene in schools. A hygiene intervention study in schools in Iran was conducted by training school children on personal hygiene and health awareness, and by demonstration and lectures, and there was also administration of leaflets and posters, slides presentation, and involvement of parents and teachers in the training. The study concluded that the awareness of students can be enhanced through practical training with the aid of materials such as leaflets, PowerPoint, instructional videos, pamphlets, and the involvement of parents and teachers.

A randomized control trial study (Moshki *et al.* 2017) also implemented a peer education-based Health Believe Model (HBM) as a strategy to promote preventive behaviors against pediculosis among fifth-grade female elementary school students in Iran. Two groups were randomly allocated to intervention on peer education on pediculosis based on HBM and the other to the control group without any intervention, and at the end of the intervention and assessment of the two groups, the results showed a higher mean score in knowledge of the intervention group.

A randomized control study in Iran conducted to determine the effective treatment of head lice on 82 school children established that lindane swiftly acted to reduce the level of lice infestation compared to permethrin. Another randomized control study in Australia, which tested the effectiveness of nonpesticide-based shampoo and malathion foam applied to the hair and scalp of the participants on days 0, 7, and 14 as per the manufacturer's instructions, established that nonpesticide-based shampoo was significantly effective in eliminating head lice than malathion foam in children. A case–control study in Thailand was conducted to screen schoolgirls ($n = 127$) for the presence of head lice and the intensity of infestation before intervention; the intervention was a health education campaign on personal hygiene. Postintervention testing was done, and the findings indicated that there was a reduction of parasitic infestation with head lice after intervention (Yingklang *et al.* 2018). Following a health education program on personal hygiene to reduce trachoma, a study in 16 schools in Brazil indicated that simple preventive measures such as proper personal hygiene and environmental hygiene prevent the spread of trachoma in school children.

Intervention strategies on the treatment of intestinal worms were on determining the uptake of PZQ in the treatment of *S. mansoni* and evaluating compliance with the WHO recommendation levels. The studies established that the uptake of PZQ in schools in Jinja Uganda was low due to fear of side effects and lack of knowledge about schistosomiasis transmission prevention and lack of teacher support (Muhumuza *et al.* 2013a, b).

Two studies in the hygiene category focused on menstrual management. A study in Bangladesh explored how schoolgirls disposed of their menstrual products and identified the girls' preferences and choices for a disposal system and piloted four different schools. The schoolgirls, teachers, and janitors preferred the chute disposable system for menstrual products since it was a durable option that did not require frequent emptying or regular maintenance (Jahan *et al.* 2020). Another study was conducted in Kenya ($n = 192$ girls) to train girls in rural areas on the use and distribution of menstrual cups during

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menstruation. The uptake differed by schools and was significantly higher among girls who experienced menarche within the past year.

Combination of WASH intervention component in schools WASH

Two interventions in the WASH category conducted cross-sectional studies in Gambia and Ethiopia on school children to assess students' hygienic conditions and their school environment for the availability of appropriate toilets and safe water supply for drinking and handwashing with soap. In one study (Alemu *et al.* 2019) on 351 students ($n = 180$ males and $n = 170$ females), the main source of water in school was pipe water; however, it was functional only for 2–4 days per week and did not fulfill the needs of the school. There were no drinking water facilities accessible to students with physical disabilities. The school had two toilets: one for males and the other for females, with one separate toilet for teachers. The toilets lacked urinals and handwashing facilities. There were no toilets accessible to students with physical disabilities, but the toilets available in the school were well designed for younger students. The school had only one handwashing station, but there was no soap available during the visit. According to Nabwera *et al.'s* (2021) study on 13 girls' schools, seven schools were English based and six were Arac based. Two hundred and fifty-three girls (71%) had access to water; the main water source in school was standpipes and hand pumps (338, 94%) as well as household source of water community standpipe (235, 66%), which was within a 15 min walk. Pit latrines with a slab were the commonest form of household sanitation (301, 84%). All the girls attended schools that had some type of handwashing facilities, and the majority had a hand-poured water system (bucket or ladle) (314, 88%) with no soap (308, 87%) and were away from the toilets (309, 86%). In case of menstrual hygiene, most girls could not afford disposable menstrual absorbents; they commonly used cloths and towels, which they washed with soap and water and then dried in the bathroom. They did not know the use of menstrual cups and tampon.

A cross-sectional multicountry study conducted in Uganda and Mozambique on 250 and 124 rural schools, respectively, to determine the association between specific WASH services and drinking water microbiological contamination established that in Mozambique and Uganda, 71 and 83%, respectively, of rural schools had low risk drinking water quality. Schools that used an improved-type water source had 0.22 times less *E. coli* in stored drinking water in Mozambique (95% CI: 0.07, 0.65) and 0.12 times less *E. coli* in Uganda (95% CI: 0.02, 0.80). In Mozambique, the use of a water source available within 30 min for travel and collection and the presence of water and soap/ash for handwashing were also significantly associated with less *E. coli* in drinking water (Morgan *et al.* 2021).

Of the 20,000 students from 200 schools, stool samples of 108 pupils from each school were collected and examined for the presence of STH before they were dewormed. A total of 1,614 (32.7%) children were infected with at least one STH species. A questionnaire was thereafter administered to them seeking information about WASH access and practice. A total of 54.7% of students reported the use of an improved water source for drinking, 84.4% of students had a household sanitation facility, 53.1% of students were not wearing shoes at the time of the interview, geophagy was reported among 17.2% of students, 54.7% of students reported the use of an improved water source for drinking, and 84.4% of students had a household sanitation facility. Handwashing facilities equipped with water and soap (27.9%) and tissue/water for anal cleansing (45.9%) were available in their households. Improved water sources were observed in 77.1% of schools. The mean pupil per latrine ratio was nearly 50:1 and 47 (67.1%).

Two studies reported WASH implementation projects conducted in schools. Both projects did a baseline assessment before WASH intervention and assessment at the end of the project. Dreibelbis *et al.* (2014) reported that the intervention arm of the project that received robust clean water to the schools, provided health education, and improved quality of latrines for the siblings of school children and their parents resulted in a decline in prevalence of diarrheal diseases among the siblings. In a 1-year DCIM WASH program, which included water supply, sanitation, WASH supplies, and education and communication activities on WASH in 100 intervention schools in Mali, the study concluded from the results that a comprehensive WASH intervention and a focus on increasing adherence may help maximize the health effects of school WASH programs (Garn *et al.* 2017).

Three studies reviewed school WASH interventions, which were conducted in Ethiopia, the United States, and developing countries. The study conducted in Ethiopia assessed the impact of access to water supply and sanitation on the prevalence of active trachoma in Ethiopia. From the systematic literature searches performed on four international databases published from January 1995 up to March 2019, the study found strong evidence that lack of access to WASH was associated with the increased prevalence of active trachoma among children. Joshi & Amadi (2013) in their systematic review explored

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the impact of water treatment, hygiene, and sanitary interventions on improving child health outcomes such as absenteeism, infections, knowledge, attitudes, and practices and adoption of point-of-use water treatment. A total of 73% ($n = 11$) of the studies were conducted in developing countries and were based on rural (53%, $n = 8$). The child's age, gender, grade level, socioeconomic index, access to hygiene and sanitary facilities, and prior knowledge of hygiene practices were significantly associated with the outcomes.

DISCUSSION

Schools are critical sites for the control and spread of many infectious diseases (Toleubekov *et al.* 2022; Seroney *et al.* 2024). The COVID-19 pandemic revealed that many schools are struggling to provide basic WASH services (Poague *et al.* 2023). Reports from monitoring and assessment of sanitary and hygienic conditions during the lockdown period in different countries also revealed the significance of WASH facilities and interventions in schools.

Though access to safe drinking water is said to be the most essential element for sustaining human life, the analysis of studies in this scoping review indicated that the quality and adequacy of water is still wanting in many schools in low- and middle-income countries. A study reported water scarcity, with only one-third of schools having water available throughout the year (Hossain *et al.* 2022). Water scarcity has been defined as not only the availability but also the quality of water and sanitation (Muhammad *et al.* 2012). The greater concern is that water scarcity is rising as a global issue since planet Earth is facing a global water crisis, which may eventually destroy the environmental sustainability of our planet. Water scarcity can be managed through effective water storage methods, water conservation, adoption of new technologies in wastewater treatment and reuse, integration of water management, and integrated governance (Zhang *et al.* 2021). Other studies have also reported that water reclamation, recycle, and reuse for demand mitigation are gaining importance in the world due to water scarcity (Rodríguez *et al.* 2020).

Available reports have shown that water samples collected from schools are contaminated with pathogenic microorganisms like coliform, *V. cholerae*, *Shigella*, and *Salmonella*. These pathogens have been shown to contribute to the burden of diarrheal diseases in low- and middle-income countries (Cissé 2019). Other studies have also indicated metal contamination of school drinking water sources, thus making children more vulnerable to the adverse effects of heavy metals. Since children consume more water in proportion to their body weight, exposure to heavy metals will damage their developing immune, reproductive, digestive, and nervous systems. The exposure to heavy metals is complicated by the fact that children have limited control over their surrounding environment and are less able to make choices to protect their health. Studies have also shown that in cases where children are already undernourished, their bodies absorb more metals due to nutrient deficiency (Ahmed *et al.* 2021).

To make water safe, there should be routine testing of the quality of drinking water sources and removal of heavy metals if present at higher levels. There is also a need to maintain control over the disposal of industrial waste in water bodies (Sankhla *et al.* 2016; Ahmed *et al.* 2021). California state has legislation stating that all schools should have a mandatory school-led testing program. The law focuses on lead since it is one of the heavy metals that has deleterious effects on children's health and cognitive functioning (Umunna *et al.* 2020). The practice in California state can be adopted by developing countries. Perveen & Amar Ul (2023) recommended in a study conducted in Pakistan that countries should implement water safety plans (WSPs) that entail comprehending the entire water system, recognizing potential issue areas, setting up management systems, and guaranteeing that all system components continue to function as envisioned.

Schools play a key role in promoting health and hygiene for their students. Despite the harmful consequences of a lack of WASH in schools, fewer than 50% of the world's primary schools can provide students with proper hygiene education (Pasewaldt *et al.* 2018). Hand hygiene is an important practice that prevents transmission of infectious diseases, and governments and nations are called to identify long-term, cost-effective alternative strategies or interventions to promote hand hygiene (Talaat *et al.* 2011). According to Mukamana & Johri (2016), school-based interventions for health promotion can be classified into two main categories: those targeting individual determinants of health such as knowledge, skills, and health behaviors, and those targeting environmental determinants such as the social and physical environment at the school, family, and community levels.

Handwashing education in elementary school could potentially impact hygiene behaviors in adulthood (Lee *et al.* 2022). One of the strategies of promoting hygiene in schools is the introduction and promotion of hand hygiene curriculum and group handwashing station. These interventions are expected to increase students' knowledge on illness prevention, adjust

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their attitudes to be more favorable toward handwashing, and generate interest and encourage consistency of the behaviors through daily planned handwashing sessions (Pasewaldt *et al.* 2018). To achieve the goals of these interventions, there is need for provision of practical training with the aid of teaching materials such as instructional videos and distribution of pamphlets with hygiene messages (Moshki *et al.* 2017; Mohammadi *et al.* 2020; Younie *et al.* 2020). The introduction of health clubs and talking messages are also recommended and have been reported to be beneficial strategies to promote hygiene and sanitation in schools (Musoke *et al.* 2018). Kandel & Lamichane (2016) formulated strategies to promote hand hygiene by incorporating the 5Es principles and 3Rs practices, which lead to increased handwashing behavior promotion and prevention of many diseases. The 5E principles include (i) embedding in a system, (ii) enabling environment, (iii) eliminating friction, (iv) encouraging all, and (v) establishing intervention; the 3Rs are practicing them religiously, routinely, and repeatedly.

Studies have reported that behavioral change therapy (BCT) can be used as a hand hygiene intervention strategy. It ensures children understand the behavior and the consequence of their hand hygiene habits. Watson *et al.* (2021) observed that BCT targets older children. Cash *et al.* (2023) explain that BCT is one of the behavioral designs that synthesizes insights from design and behavioral science to deliver interventions that shape behavior.

Peer education based on the HBM is an effective strategy to promote preventive behavior. HBM is reported to be the most significant model that is applied in promoting preventive behavior in communities and populations (Joorbonyan *et al.* 2022). Conventionally, behavior is dependent on a person's knowledge and attitude. People's knowledge and attitude will cause them to sense a health threat and guide them to healthy behavior (Baghianimoghadam *et al.* 2012). A combination of HBM and social learning theories has been applied as health education strategies in schools in an intervention study on infectious diseases (Wang *et al.* 2023).

Lack of access WASH is associated with the increased prevalence of active trachoma among children. Trachoma is the world's leading cause of preventable blindness. WHO proposes a SAFE strategy that is aimed at eliminating trachoma, particularly in schools. The strategy has four components, two related to treating the disease by 'surgery' and use of 'antibiotics' and the other two components related to long-term prevention by promoting 'facial' cleanliness and 'environmental' (SAFE) changes, which include improving access to water and sanitation or reducing the breeding grounds for flies (Stocks *et al.* 2014; Chen *et al.* 2021). Tadesse *et al.* (2017) add that health promotion is essential to the SAFE elimination strategy of trachoma, especially since it addresses the 'F' and 'E' components. Schools are a valuable venue for trachoma health promotion because of the susceptibility of school children due to their age. Schools also have many mechanisms already built in for health education and health promotion including teachers, various education tools, and positive peer pressure among students. Therefore, health messages communicated in a school environment have the potential to reach SAC in most households from diverse socioeconomic backgrounds (Chen *et al.* 2021).

Tadesse *et al.* (2024) summed STH and schistosomiasis interventions based on three pillars: the first is conducting large-scale or mass deworming; second, by improving WASH to reduce environmental contamination with infectious stages; and third, by giving school children health education to alter behavior to reduce environmental contamination and risk of infection. Large-scale deworming programs are viewed as short-term interventions to reduce morbidities from STH. Though WASH interventions have been recommended as better strategies for controlling the transmission of STH in schools, preventive chemotherapy is said to work better in reducing morbidities caused by STH and schistosomiasis (Grimes *et al.* 2016). It is recommended that long-term and sustainable interventions can be adopted like an environmental sanitation program that has been proposed as an intervention to eliminate STH infections though complex and expensive. This will involve extensive public investment in improving access to safe water and sewerage systems (Mascarini-Serra 2011). The introduction of the health education board game knowledge and ladder as a health education strategy has been reported to improve knowledge, attitudes, and practices of school-going children about transmission of STH (Bassey *et al.* 2020). McManus *et al.* (2014) say that health education on worm infestation can also be done through providing videos and recorded dramas to school children and by conducting household sanitary surveys.

WHO advocates the use of multiple strategies for vector-borne disease prevention through the integrated vector management (IVM) program for the control of mosquito vectors including those that transmit dengue fever (Achee *et al.* 2015). Tozan *et al.* (2014) reported that interventions such as application of larvicides and adulticidal insecticide space spraying have been relied on as methods of reducing the population of vectors such as dengue, yet they have limited impact on the increasing incidence and geographical expansion of dengue in endemic countries. The authors argue that there is an urgent need for practical, acceptable, and affordable measures to protect vulnerable children in schools. A recent review on the safety and effectiveness of the use of insecticide-treated clothing indicated that it is a promising intervention. Other interventions like

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health education in primary school have succeeded in increasing children's knowledge and participation in dengue prevention and control programs (Overgaard *et al.* 2022).

Menstrual hygiene management (MHM) for school-aged girls in low- and middle-income countries can be challenging. Because of limited funds for, and access to, high-quality hygiene products and poor sanitary conditions to deal with menstruation, the situation demands attention (van Eijk *et al.* 2018). Hygiene interventions that provide better menstrual management to schoolgirls thus may have a role in improving schooling, equity, sexual and reproductive health, and wellbeing. Poor MHM has led to girls' stigmatization due to menstrual blood leaking at school, and girls also lack ability to focus on lessons and therefore they may be forced to withdraw from school activities and even prefer to stay at home during menstruation (Mason *et al.* 2013; van Eijk *et al.* 2018). A substitute for using sanitary pads is the use of the menstrual cup. The menstrual cup has been explored as a means of menstrual hygiene management in developing countries including India, Tanzania, and Kenya. It is a device for menstrual flow management and is claimed to be a health and environment-friendly alternative to the conventional menstrual sanitary protections. It is reported that the menstrual cup is more affordable than disposable pads, one of the reasons being that it is reusable (Alzate & Sánchez 2020; Mouhanna *et al.* 2023). Research studies on the use of menstrual cups among school girls indicated the significant uptake among girls who have been educated on the use and have used the menstrual cup before (van Eijk *et al.* 2018).

Another hygiene intervention in schools presented in the reviews is on management and control of head lice infestation in school children. Among many factors that increase the prevalence of head lice are poor hygiene and social-economic status of the communities (El Magrabi *et al.* 2015). Sangaré *et al.* (2016) recorded that since World War II, many insecticides/pediculicides, including organochlorines (DDT, lindane), organophosphates (malathion), carbamates (carbaryl), pyrethrins (pyrethrum), and pyrethroids (permethrin, phenothrin, and bio allethrin), have been used to treat head and body lice. There has been an emergence of new approaches in the management and control of pediculosis among school children; drug combinations, for example, the use of pediculicides with antibiotics, have been shown to have better outcomes in eliminating head and body lice. Pediculicide ivermectin provides antifilarial activity with ancillary benefits on intestinal helminths and ectoparasites, such as jiggers and lice, combined with antibiotics such as doxycycline, erythromycin, and azithromycin, which treats some infections that may have resulted in or are linked to lice. Other recommendations include erythromycin + ivermectin, rifampicin + ivermectin, and azithromycin + ivermectin (Menozzi *et al.* 2015). In addition to new approaches in the management and control of headlice in schools and communities, health education and health promotion programs are still recommended (Khamaiseh 2018). Collaboration between the Ministry of Education and the Ministry of Health in governments in addition to training teachers, school health workers, students, and their parents will be effective in the prevention and control of head lice infection (Mohammadi Azni 2014).

Barriers toward access to WASH facilities in schools

Without an enabling environment, school WASH programs are likely to fail. It is paramount to acknowledge that there are various barriers linked to access to WASH in schools. These barriers need to be identified for effective WASH interventions. Barrier identification can also contribute toward the mitigation of their influence on WASH provision in schools. Infrastructural challenges, climate change, inequality in WASH facilities, financial challenges, and policy and institutional challenges are some of the constraints toward school WASH provision (Shrestha *et al.* 2023).

Climate change is one of the biggest environmental threats on the planet Earth. It has an immense impact on people's health. Climate change affects water to the greatest extent, causing pollution, water scarcity, and excess water in some regions. Bulti & Yutura (2023) note that the 2023 Agenda for Sustainable Development Goal number 6 on ensuring access to water and sanitation has been complicated owing to high vulnerability to climate change, and so there is a need for additional technology and financial investment to address existing challenges. The operations of water supply networks have been notably altered because of climate change.

Many countries have policies regarding WASH in schools, but they are reported to be underfunded and occasionally enforced. In the schools where the WASH program is funded, it is more likely that the budget line is inclined toward capital costs of building water, hygiene, and sanitation infrastructure, but not the cost of operation and maintenance of the WASH infrastructure (Deroo *et al.* 2015).

According to Tseole *et al.* (2022), inadequate financing is one of the barriers to effective WASH interventions in schools, especially in low- and middle-income countries. Insufficient funds may contribute toward a lack of skilled personnel and poor laboratory equipment, which results in compromising the quality of water and water supply services in schools. It is

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recommended that technical aspects such as design aspects, operation monitoring, final water quality compliance monitoring, plant monitoring practices, maintenance, and risk management practices should be considered in water service provision.

The United Nations SDG 6 set the agenda for addressing inequity in global access to water for all by 2030 with goal number 10 aiming at reducing inequalities between and within countries (Tetteh *et al.* 2022). It is said that countries with greater inequality in access to improved water experience more severe inequality in access to improved sanitation. The marginalized people and out-of-reach areas suffer the compound effect of unimproved water and sanitation, as well as inadequate hygiene services. An annual report by the Indonesian government through the Ministry of Education on WASH facilities in schools at the national and regional levels indicated existing disparities in the distribution of WASH facilities at the provinces, with the highest and lowest hygiene indicators for DI Yogyakarta Province at 92.0% and Papua Province at 45.59% (Unggul & Nurul 2023). Addressing inequalities related to WASH is critical to develop adequate strategies to prevent and control many infectious diseases (Cha *et al.* 2021).

Limitations

Methodological limitations in the included studies contribute to the uncertainty of the study findings. The studies reviewed have variability in intervention designs, implementation, settings, time of conducting study, and their implementation, and these factors pose challenges in drawing authoritative conclusions and comparing WASH outcomes across the studies. MMAT when applied to diverse WASH intervention studies can be too complex and time consuming depending on the number of studies involved and the type of research study. In WASH intervention studies, some questions may not apply to certain types of mixed-method research, which could lower the study score.

CONCLUSION

Quality and adequacy of water are still in jeopardy in many schools in low- and middle-income countries. There are various ways of managing water scarcity and environmental sustainability through effective water storage methods, water conservation, adoption of new technologies in wastewater treatment and reuse, and integration of water management and integrated governance. To ensure water quality, it is recommended that there should be routine testing of drinking water sources to comply with WHO guidelines and removal of heavy metals if present at higher levels.

School-based interventions such as BCT, peer education based on the HBM, introduction and promotion of hand hygiene curriculum, group handwashing station, and health education board game knowledge and ladder are effective strategies in preventing diseases and promoting health in school children.

MHM for school-aged girls in low- and middle-income countries is still challenging due to limited funds for, and access to, high-quality hygiene products and poor sanitary conditions to deal with menstruation. Hygiene interventions that provide better menstrual management to schoolgirls thus may have a role in improving schooling, equity, sexual and reproductive health, and wellbeing.

The interventions to manage and control soil-transmitted helminthiasis and schistosomiasis in school children have been summed based on three pillars, that is, conducting large-scale or mass deworming, improving WASH to reduce environmental contamination with infectious agents, and giving school children health education to alter behavior to reduce environmental contamination and risk of infection. Drug combinations have emerged as a new approach in the management and control of pediculosis among school children.

Multiple strategies for vector-borne disease prevention through the IVM program for control of mosquito vectors including those that transmit dengue fever are advocated for as an environmental sanitation intervention in schools.

Recommendation

The following is recommended from this scoping review: The governments need to implement effective interventions that will assist schools to attain SDG 6 by 2030 through the implementation of WSPs for all water systems and enforcement of policy on routine testing of quality of drinking water for the entire population, including schools.

There is a need to enforce and maintain control over the disposal of industrial waste in water bodies by the relevant bodies in each government or nation.

Collaboration between the Ministry of Health and the Ministry of Education in countries is recommended to ensure that health education and health promotion strategies on WASH in schools are incorporated into the education system in schools.

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More research should be conducted on practical, acceptable, long-term, and cost-effective disease preventive strategies for school children. There is a need for further research on the evaluation of WASH facilities in schools.

Ministries of Education should advocate for adequate budgetary allocation to capital infrastructure and operation and maintenance of WASH facilities in schools.

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ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

This study did not include human or animal participants; therefore, it did not require ethical approval and consent from anyone.

CONSENT FOR PUBLICATION

Not applicable.

AUTHOR CONTRIBUTIONS

G.C.S. and G.G.M. conceptualized the scoping review paper and G.C.S. prepared the draft scoping review paper. G.G.M. and N.A.G.M. critically revised the paper. G.C.S., G.G.M. and N.A.G.M. contributed to the development of the methodology of the scoping review. G.C.S. prepared the manuscript and G.G.M. and N.A.G.M. critically reviewed it. G.C.S. participated in accessing library resources and search strategy and writing the manuscript. G.C.S. and N.A.G.M. edited the manuscript. All authors (G.C.S., G.G.M. and N.A.G.M.) reviewed and approved the final scoping review manuscript.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

CONFLICT OF INTEREST

The authors declare there is no conflict.

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Connecting text

The preceding chapter, chapter 2, comprised the literature review segment of this research study and a published systematic scoping review paper. The forthcoming section, Chapter 3, outlines the research methodologies utilized in the investigation. Methodology is described across three distinct phases, reflecting the multi-phase, mixed-methods approach adopted for the study. Phase 1B details the methodology addressing the second research objective: a critical analysis of WASH interventions implemented in primary schools within Uasin Gishu County, Kenya. Phase 1A was previously discussed through the systematic scoping review. Phase 2 specifies the methodology applied to achieve the third research objective, which involves developing a suitable WASH intervention for primary schools in Uasin Gishu County. Finally, Phase 3 presents the methodology for the fourth research objective, focusing on the short-term outcome evaluation of the selected WASH intervention in the schools.

3.0 CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter outlines the study's methods, including research planning, participant selection, sample size, data collection tools, procedures, and analysis.

3.2. RESEARCH DESIGN

The study employed a multi-phase, mixed-methods, case study design. The study is appropriately described as a multi-phase, mixed-methods multiple-case study because it comprises sequentially linked phases that progressively address different objectives (multi-phase), integrates qualitative and quantitative data sources to provide a comprehensive understanding of school WASH interventions (mixed-methods), and employs a multiple-case (embedded) design involving different schools across sub-counties to enable cross-case comparison, replication, and strengthened validity of findings (multiple-case study). This integrated design enhanced methodological rigor by enabling triangulation across methods, replication across cases, and progressive refinement of interventions across phases, thereby increasing the validity, credibility, and applicability of the study findings (Creswell, 2014; Yin, 2009).

This study did not formulate formal hypotheses because it adopted an exploratory, multi-phase mixed-method case study design aimed at understanding and developing WASH interventions in complex real-world school contexts. The study was guided by research questions rather than hypotheses in line with qualitative and inductive research traditions, where the objective is to generate in-depth understanding and inform intervention development rather than test pre-specified relationships between variables (Creswell, 2014; Yin, 2009).

3.2.1. An overview of the case study project

Unit of analysis

In case studies, the case is defined by its unit of analysis. Stake (2013) explains that a case brings together different functions and relationships for study. In multiple-case research, cases should share similarities, such as being groups of teachers, a national care clinic program, schools, or clinics.

The case in this study was schools in the six Sub-Counties, with all its embedded units of analysis being the WASH program. Each case included several units of analysis: study participants (schoolteachers, head teachers, government officials, and other stakeholders), WASH program interventions, document analysis, and School WASH program models.

3.2.2 Case protocol

This section describes the protocol used to guide the first phase of the study**.**

A case study protocol describes the processes and procedures for conducting research before, during, and after the project (Pervan and Maimbo 2005). It covers the project overview, objectives, data collection methods, and reporting guidelines (Mchunu 2007). Pervan and Maimbo (2005) also note that protocols help ensure consistency when multiple researchers collect data in different locations. The protocol for this study was organized as follows:

The initial section of the protocol provided an overview of the case study project. The following section focused on outlining the objectives of the case study, while the third section detailed the procedures for data collection. Additionally, the protocol included a discussion of the research questions and conceptual framework.

3.2.3 Phases of the study

This was a case study with multiple phases, each using different methods. The study had three phases. Phase 1 documented the status of school WASH interventions in low- and middle-income countries through a previous scoping review and explored WASH interventions in public and private primary schools in Uasin Gishu County. Phase 2 developed an appropriate intervention for effective and sustainable WASH in schools using the Delphi technique. Phase 3 evaluated the short-term outcomes of the intervention in primary schools.

PHASE 1

Phase 1 of the research had two parts: Phase 1A mapped evidence on the status of WASH interventions in primary schools in low- and middle-income countries, while Phase 1B explored the current status of WASH interventions in public and private primary schools in Uasin Gishu County.

3.2.3.1 PHASE 1A: TO MAP EVIDENCE OF STATUS OF WASH INTERVENTIONS IN PRIMARY SCHOOLS IN LOW- AND MIDDLE-INCOME COUNTRIES

The goal of Phase 1A matched the first objective of the research. A scoping review in the *Journal for Water, Sanitation and Hygiene and Development* mapped WASH intervention status in primary schools across low- and middle-income countries. The published article is included in the literature review section of this dissertation. Table 1 gives an overview of the research design and methods used in Phase 1A.study.

Table 2: An overview of the research design and methods of phase 1A

PHASE 1A: Scoping review					
Research objective I	**Study design**	**Population and sampling**	**Data collection**	**Trustworthiness**	**Data analysis**
Phase 1 (i) To map evidence of status of WASH interventions in primary schools in Low- and Middle-Income Countries	Scoping review guided by Arksey and O'Malley's framework	Peer-reviewed and grey literature published between 2000 to 2021 Following an eligibility criterion	Systematic review and scoping review of WASH interventions in primary schools in Low- and Middle-Income Countries guided by Arksey and O'Malley's framework Literature search from databases: Academic search complete, PubMed, CINHAL, Google scholar and Scopus	Use of key words methods to answer research question. Three stage screening of the articles: title, abstract and full text screening Use of free web-tool Rayyan for screening	Data extraction and content thematic analysis by use of Nvivo version 12

3.2.3.2 PHASE 1B: TO CONDUCT A CRITICAL ANALYSIS OF WASH INTERVENTIONS IN PRIMARY SCHOOLS IN UASIN GISHU COUNTY, KENYA.

Phase 1B aimed to assess WASH interventions in public and private primary schools in Uasin Gishu County, Kenya by addressing resources, activities, and outcomes related to the WASH program.

A case study design was chosen for this phase because it enables detailed investigation of a phenomenon using various sources, as noted by Crowe *et al*. (2011). The focus was the school's WASH program, and the researcher aimed to gather detailed information from various sources.

The case study approach helps answer explanatory questions such as ‘how’, ‘what’, and ‘why’ (Crowe *et al.* 2011). In this phase, the researcher examined which WASH interventions have been implemented in public primary schools, what policy guidelines exist, how funds are allocated and disbursed, and the roles of schools, county, and central government in implementing WASH programs. A multiple-case design was used instead of a single-case design because, as Mchunu (2007) notes, multiple sources of

evidence strengthen findings. Crowe *et al*. (2011) also note that multiple cases allow for comparisons and replication, thereby making results more robust and credible.

Case study designs can be divided into four categories: single-case (holistic), single-case (embedded), multiple-case (holistic), and multiple-case (embedded). The design chosen for this research was a multiple-case (embedded) approach, as described by Yin (2009). According to Gustafsson (2017), studies involving multiple cases may yield results that are either similar or contrasting.

Case 1 &2 (primary schools in Sub-County 1&2)

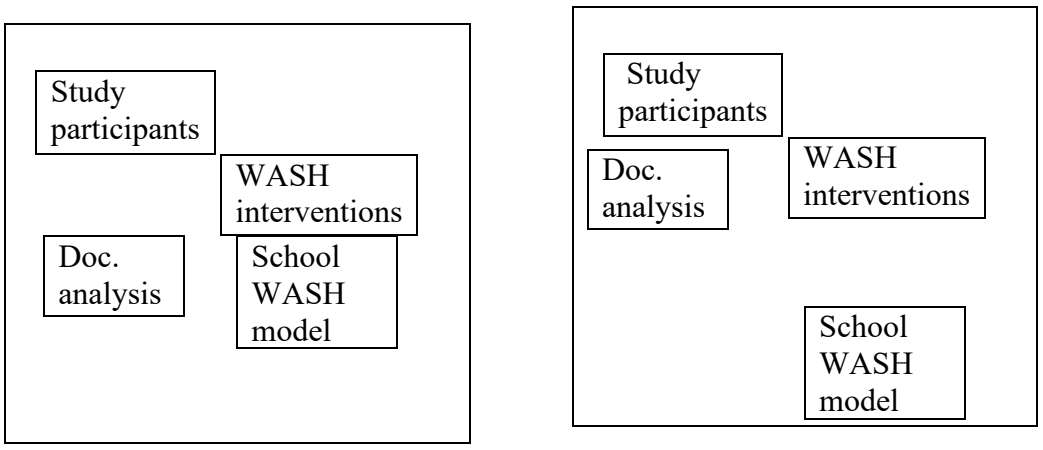


Figure 3: Illustration of a case and unit of analysis

In this study, the primary school was the case, and the WASH program represented unit of analysis. Data on WASH programs in schools were collected from multiple sources. Both quantitative and qualitative methods were used, including questionnaires, observation checklists, document analysis of School WASH Policy and guidelines, and focus group discussions (FGD). Yin (2003) suggests that using both approaches helps develop a thorough understanding of the case. Table 3 summarizes the research design and methods used in Phase 1B for objective 2.

Table 3: Overview of the research design and methods of phase 1B

Phase 1 B					
Research objective 2	**Study design**	**Population and sampling**	**Data collection**	**Trustworthiness**	**Data analysis**
(ii) To conduct a critical analysis of WASH interventions in public primary schools in Uasin Gishu County, Kenya.	Case study Quantitative Methods	Study populations are public primary schools in Uasin Gishu County. Proportionate sampling of primary schools in the 6 sub-counties. Purposive sampling of head teacher and, teachers	Quantitative data: observation checklist, structured questionnaire	Validity and reliability testing of the instrument	Descriptive statistics-frequencies, counts, and means use of SPSS
	Qualitative Methods	Purposive sampling of 1 teacher in each school selected from each sub-county	Focused Group Discussion and	Use of focus group methods. Use of open-ended and semi structured questions	Grouping or categorization of emerging themes and interpreted Content analysis
		Systematical review of 12 key documents on school health and education policy	Document analysis of School WASH and education policy and guidelines	Development of data extraction table with pre-determined dataset from school health and education policy	Deductive-inductive thematic analysis

3.3 RESEARCH SETTING

Location of the study area

The study area, Uasin Gishu County, is one of the 47 counties of Kenya located in the mid-west of Kenya's Rift Valley. It shares borders with Trans Nzoia, Elgeyo Marakwet, Baringo, Kericho, Nandi, and Kakamega Counties. It is situated some 330km Northwest of Nairobi, Kenya. Uasin Gishu county population stands at 1,163,186 with a growth rate of 3.8%. The population density is 343 persons per sq. kilometers, according to the 2019 Kenya population and housing census.

The county is divided into six sub-counties: Turbo, Soy, Anabkoi, Moiben, Kesses, and Kapseret. There are 489 public primary schools in the county. Uasin Gishu was selected for this study because WASH programs are implemented nationwide, and it is one of the 47 counties where the program operates.

3.4 POPULATION AND SAMPLING TECHNIQUES

3.4.1 The study population

The study population comprised 498 public primary schools in Uasin Gishu County.

3.4.2 Sampling

In case study research, cases are not selected through statistical sampling; instead, selection is guided by logical and theoretical considerations. Case studies typically rely on theoretical sampling, whereby cases are deliberately chosen to replicate, refine, or extend an emerging theory. Regardless of the specific case selection strategy, the central principle is that cases should be information-rich and suitable for in-depth investigation (Ebneyamini & Sadeghi Moghadam, 2018). As Mchunu (2007) notes, case study research does not require a minimum number of cases, nor does it depend on random selection; rather, researchers work with the situations as they naturally occur. Importantly, representativeness is not the primary criterion for case selection. Instead, cases are purposefully chosen either to produce similar outcomes for predictable reasons or to generate contrasting results that can be explained a priori (Ebneyamini & Sadeghi Moghadam, 2018).

3.4.2.1. Sampling of primary Schools

Proportional sampling was used to determine the number of primary schools to be included in the study. This is a type of sampling in which the number of elements assigned to each stratum is proportional to the stratum's representation in the target population. (Iliyasu and Etikan 2021) explains that proportional sampling involves selecting samples from each stratum in proportion to the strata's relative size within the population.

In the study, proportional sampling was used to allocate schools based on their relative contribution to the total number of schools in Uasin Gishu County total number being 489 and whether they are urban or rural schools. For sub-county like Soi which had the highest number of schools 117, it contributed higher proportion compared to a sub-county like Kapseret which had 53 schools. Proportional sampling was appropriate because it ensured that the distribution of sampled schools reflected the true population structure, thereby preventing overrepresentation or underrepresentation of any sub-county.

3.4.2.2. Sample size calculation

To apply proportional sampling, the researcher calculated the sample size by determining the percentage each sub-county's schools contributed to the total number of schools in Uasin Gishu. The formula used was: Sample schools in a sub-county (n) = Number of schools in a sub-county (x) / Total number of schools (498). Sub-counties with more schools contributed more cases and Sub-counties with fewer schools contributed fewer but proportionate cases

The sampling frame included primary schools grouped as urban or rural according to infrastructure differences; rural schools would be located far away from the main tarmac roads, they are not close to social amenities, piped or/ and treated water supplies and electricity (UNICEF & WHO 2022a).

Table 4: Selection of primary schools

Sub-county	Total Number of schools	Proportion	Targeted sample	Urban/shopping Centre/ near tarmac road	Rural/village no nearby shopping Centre/ no near tarmac road
Turbo	83	0.2	8- 8	4	4
Soi	117	0.2	12-8	6	6
Ainabkoi	66	0.1	7-7	3	4
Moiben	90	0.2	9-8	5	4
Kesses	89	0.2	9-8	4	5
Kapseret	53	0.1	5- 6	3	2
Total	498	1.0	50	25	25

Table 4 shows that a sample of 50 schools, distributed proportionally across the six sub-counties and balanced between urban and rural schools, was enough to evaluate the WASH program.

3.4.2.2 Sampling of the respondents

The school head teacher and teachers, as part of the sample, were purposefully selected to participate in the study from the selected schools. Only teachers were selected from each school to participate in the FDG because they represented how WASH had been implemented in their schools and because of the challenge of power dynamics in conducting an FGD with a heterogeneous group. Even though there is a suggestion for not having a minimum number of cases or random case selection (Mchunu 2007; Schoch 2020), Schoch (2020) explains that case studies have a sample of one, that is, the bonded cases; this means that a researcher can conduct sampling within a case. The author continues by stating that, in multiple case studies with several cases for comparison, the researcher can use a selection method known as purposive sampling. This is where the researcher can select the cases, as well as the individuals, documents, and artifacts within each case. Purposeful sampling enables the researcher to get to the bottom of the phenomenon under investigation. Purposeful sampling aims to identify cases that offer insight into the specific situation studied, not to represent the general population (Schoch 2020). From the 6 sub-counties in Uasin Gishu County, 3 sub-counties were at randomly selected from where the teachers who

participated in the FGD were picked from. With the assistance of the Sub- County education officer, a list of public and private schools was made. The officer then, considering urban and rural schools in their sub-county, 5-7 schools were picked and the head teacher of the schools was requested to nominate 2 teachers from each school. An FGD constituted around 10- 15 participants. Once nominated the teachers were invited through a phone call to attend a meeting where they could be requested to participate in the FDG.

3.4.2.3. Eligibility criteria

Inclusion criteria for schools

1. Public and private primary schools recognized by the Ministry of Education in Kenya.
2. Public and private primary schools with both boys and girls in Uasin Gishu County
3. Day and boarding school both public and private primary schools in Uasin Gishu County

Exclusion criteria

A public and/or private primary school that had not had candidates for Kenya Certificate of Primary Education

Public and/or private primary school that were on session during research study period

3.5 DATA COLLECTION PROCEDURES

This study used a mixed-methods design, integrating qualitative and quantitative approaches to collect and analyze data. This method provides a more complete understanding of the research problem and allows for triangulation of findings (Schoonenboom and Johnson 2017).

Qualitative data were collected through Focused Group Discussion of teachers in selected schools in the County of Uasin Gishu. There were 3 FGDs conducted from the three randomly selected sub-counties from which 2 teachers from each school participated in the FGDs. The interviewer presented information letter and consent form for introduction to the session and signing of the consent form. The session was guided by reading unstructured questions to the participants and giving one person at a time to respond. The responses were audio- recorded and note-taking of verbal and non-verbal communication was documented. The interview lasted around 40 minutes- 60 minutes.

Document analysis of Kenya's national school health and education policies, guidelines, strategies, and legislative frameworks related to WASH in schools was conducted to provide supplementary data concerning the policy documents and guidelines related to the WASH in primary schools in Kenya.

A deductive–inductive thematic document analysis was conducted on national school health, education, WASH and menstrual health management (MHM) policy instruments published between 2008 and 2024.

Quantitative data was collected using a structured questionnaire given to school head teachers. An observation checklist was used to assess WASH infrastructure and observe students' WASH behavior. Data was entered into a mobile-friendly app (Commcare), and then uploaded to a server. Records were downloaded in CSV format, along with data dictionaries, for analysis. It took about 30 to 45 minutes for head teachers to complete the questionnaire.

Various data collection instruments were prepared for different respondents. The items in the data collection tools varied by respondents because the information collected was unique to some groups. The research instruments used for this study are outlined below:

3.5.1 Data Collection Instruments

Instrument 1: Structured questionnaire

Instrument 1 was a questionnaire designed to collect quantitative data from the school. An adopted and modified WHO and UNICEF questionnaire was used to gather information on WASH in the schools (World Health Organization and United Nations Children's Fund 2019)

The first part of the questionnaire asked the head teacher or someone in charge of WASH for basic information about the school. The second part asked about the roles of head teachers in school WASH, costing and funding of WASH, how the WASH program is managed, and how it is monitored. Other questions were about whether WASH facilities were available, working, private, and easy to use, of good quality, well maintained, and about WASH education.

Instrument 2: Observational check list

Instrument 2 was a structured observational checklist used for quantitative research. It focused on water supply and storage infrastructure, the condition and adequacy of latrine facilities, access to drinking water and hand washing facilities, environmental cleanliness, records of teacher and pupil training, plans for

operating and maintaining WASH facilities, health promotion programs, inclusion of WASH messages in the school program, and other WASH-related resources. The sources of literature for the observation checklist included activities of WASH and WASH strategies, as outlined in the Kenya School Health Implementation Guidelines, the National School Health Strategy Implementation Plan 2011-2015, and the Kenya School Health Policy. The WHO and UNICEF questionnaire was also used to gather information on WASH in the schools (World Health Organization and United Nations Children's Fund 2019).

Instrument 3: FGD Interview guide - Primary School teachers

Instrument 3 was a focused group discussion (FDG) designed to collect qualitative data from school teachers who participated in the study. The FDG was designed to gather data on training of teachers on WASH, their role in the WASH program, their participation in school WASH health promotion activities, the availability and adequacy of WASH facilities to teachers, and policy and guidelines guiding their WASH program.

Instrument 4: Interview guide – WASH Experts

Instrument number 4 applied a qualitative method to collect data. An interview guide was used to collect data from school head teachers and WASH experts. There were to separate interview guide for the school head teachers and the WASH experts. To the head teachers, the interview guide was designed to gather information on policy and guidelines in place for executing the WASH program in primary school; the role of the head teacher in coordinating WASH program activities in schools; financing of WASH; structures in place for operation, monitoring, maintenance and reporting of WASH program activities; information on training of teachers and pupils on WASH; active ongoing health promotion activities in relation to WASH in school; availability and adequacy of WASH facilities in the school.

The interview guide for the WASH experts were conducted with government officials in charge of WASH at the county level and with other stakeholders / non-governmental organizations engaged in WASH program activities in Uasin Gishu County. The questions were designed to gather information on

the policies and guidelines in place for executing the WASH program in primary schools, planning and coordinating the WASH program in schools, financing, budgeting, and monitoring and evaluating the school WASH program in the county. The instrument construction was based on the study framework, input component of the WASH conceptual framework for schools applied in this study and the appropriate research question. The interview also included questions on the objectives of WASH and WASH strategies, as outlined in the Kenya School Health Implementation Guidelines, the National School Health Strategy Implementation Plan 2011-2015, and the Kenya School Health Policy.

Instrument 5: Document analysis guide

Instrument number 5 was a document analysis of WASH in schools. Data was collected and analyzed from documents using qualitative methods. The following documents were analyzed: Kenya National School Health Policy, 2009; National school health guidelines, 2009; Safety Standards Manual for Schools in Kenya, 2008; National School Health Strategy Implementation Plan 2011/2015; Kenya school health policy, 2018; Kenya School Health Implementation Guideline, 2018; Guidelines on Health and Safety Protocols for Reopening of Basic Education Institutions Amid Covid-19 Pandemic; The basic education act, 2013; Basic Education Bill, 2024; Kenya Water Sanitation and Hygiene (WASH) in schools Strategy 2024 – 2029; Kenya Menstrual Hygiene Management policy 2019-2024; and the Kenya Menstrual Hygiene Management (MHM) Strategy 2024-2029. Table 4 provides a summary of the quality of case study design and instruments employed in the study.

3.5.2 Quality of instruments

The tools used to collect information were made by the researcher. So, it was important to check whether these tools measured what they were supposed to and provided consistent results as illustrated on table 5.

3.5.2.1. Validity testing

The sources of literature for the instruments utilized in phase 2 of the study included activities of WASH and WASH strategies, as outlined in the Kenya School Health Implementation Guidelines, the National School Health Strategy Implementation Plan 2011-2015, and the Kenya School Health Policy. The WHO

and UNICEF questionnaire was also used to gather information on WASH in the schools (World Health Organization and United Nations Children's Fund 2019). A WASH program expert and the research supervisors reviewed the instruments to ensure all relevant content was covered and that the instruments measured what they were intended to measure. The instruments were designed based on the research questions.

3.5.2.2. Reliability testing

Reliability means how well a tool gives the same results each time it is used. This is measured using a number called a correlation coefficient. A value of 1.00 means perfect reliability, while 0.00 means no reliability. Higher numbers indicate more stable results, and values of 0.70 or higher are considered good enough.

In this study, the researcher tested reliability in the following ways:

1. The researcher conducted pretesting of the instrument. The pretest of the instrument (a structured questionnaire and an observation checklist) was conducted in Nandi County, where School WASH has also been implemented. Since this is a case study 10% of the sample size (50 schools) is adequate for pre-test; therefore, 5 schools were used for pre-testing. Five schools were selected, 3 from an urban setting and 2 from a rural setting.
2. While conducting interviews, the researcher had an interview protocol or a list of questions and prompts used to interview respondents.
3. During observation, the researcher developed a list of questions or protocol; this ensured that the interviewers understood what they were looking for and how the observations helped answer the research questions (Schoch 2020).
4. Another way to ensure instrument reliability is to collect data across the full range of appropriate settings and at different times from different respondents (Mchunu 2007). This was achieved in the study by using a structured questionnaire and an observation checklist, and by conducting a focused group discussion.

Table 5: Quality of case study design and instruments (adapted from Yin, 2009: 40)

Case study			
Test	**Case study tactic**	**Phase**	**Example**
Construct validity	The use of multiple sources of evidence (triangulation)	Data collection	Instrument 1- 5
	Key informants review draft case	Data collection	Phase 2: Development of appropriate intervention
Internal validity	Pattern matching	Data analysis	Phase 2 of the study: Delphi round 1 Cross case analysis
	use of logic models	Framework development	Theoretical framework of the study
External validity	Use of replication logic	Research design Data analysis	Case study protocol
Reliability	Use of case study protocol	Data collection	The study
Data collection instrument			
Test	**Instrument tactic**	**Instrument**	**Phase**
Content validity	Aligning content to framework and objectives	Instrument 1: structured questionnaire Instrument 2: Observation checklist instrument 3: FGD Instrument 4: KII Instrument 5: Document analysis	Instrument development
Construct validity	Triangulation of methods	The use of instrument: structured questionnaire instrument 2: Observation checklist instrument 3: FGD Instrument 4: KII Instrument 5: Document analysis	Data collection
Reliability	case study protocol Triangulation Definition of terms	Case study protocol Development of case study data base Definition of terms	Data collection Data analysis

	Pre-testing	Instrument 1: structured questionnaire Instrument 2: Observation checklist	Instrument development
	Use of interview protocol	Instrument 2: FDG	Data collection
	Triangulation methods of data collection	Instrument 1: structured questionnaire Instrument 2: Observation checklist instrument 3: FGD Instrument 4: KII Instrument 5: Document analysis	Data collection

Trustworthiness and credibility

The researcher used semi-structured interviews with open-ended questions to enhance the trustworthiness and credibility of the collected data.

3.5.3 Quality of research design

To assess the quality of research designs in empirical studies like case studies, Yin (2003) suggests four tests: (1) internal validity, (2) construct validity, (3) external validity, and (4) reliability.

3.5.3.1 Internal validity

Internal validity refers to how well the observed results in a study reflect true reality and are not influenced by external or confounding variables (Polit and Beck 2004). Ways to increase internal validity in case studies include using logic models, pattern matching, and explanation building.

The researcher used a logic model in the study and, to answer the final research question, conducted cross-case analysis as a form of pattern matching.

3.5.3.1. Construct validity

Yin (2003) outlines three tactics for increasing content validity when doing case studies, the first of which is the use of several sources of data which is referred to as data triangulation for both qualitative and quantitative techniques; the second tactic establishes a chain of evidence done during data collection, and the third tactic involves review of the draft case study report by the key informants. In this study, the researcher used multiple sources of evidence from both quantitative and qualitative methods, including structured questionnaires, in-depth interviews, focus group discussions, document review, and observation. A chain of evidence was established in this study by collecting data from divergent respondents, including school pupils, head teachers, teachers, county government officials, and other stakeholders.

3.5.3.2. External validity

It refers to the extent to which study findings can be applied or applied beyond the specific study setting or population. As explained earlier by Ebneyamini and Sadeghi Moghadam 2018), case studies cannot be generalized; they rely on analytical generalization. Analytical generalization does not involve selecting cases to represent a wider population. Instead, it focuses on extending the study findings to broader theoretical concepts. In this study, the researcher used pattern matching as an analytical generalization strategy. Pattern matching was performed by comparing primary school results across sub-counties and between rural and urban schools

3.5.3.3. Reliability

The goal of reliability, according to Yin (2003), is not the replication of study findings but rather the reduction of errors and biases in a study. Reliability in case studies means that repeating the study produces the same results, provided the procedures are consistently applied and documented. The use of a case study protocol during data collection helped achieve reliability in this study. The protocol guided the researcher in the data collection process.

3.5.3.4. Guide for the report.

The researcher was guided by the logic and WASH FIT framework in discussing the results of phase 1. The research questions also guided the writing of the research results.

3.6 DATA ANALYSIS

The data were analyzed descriptively using frequencies, counts, and means, and the results were presented. These summaries aim to describe the situation by highlighting the key numerical features of the data.

Qualitative data from FDG interviews were analyzed by comparing and grouping respondents' views in NVivo, rather than through formal categorization. Emerging themes were then grouped and interpreted (Faulkner and Trotter 2017).

In relation of document analysis, data was analyzed qualitatively. The extracted data were subjected to content analysis to uncover patterns and trends by comparing findings across sources. Documents were compared based on 18 categories of information, including title, author, publication year, document type, foreword, preface, acknowledgment, policy background, goals, and thematic components such as water, sanitation, hygiene, food safety, MHM, organizational structure, advocacy, capacity building, and monitoring and evaluation.

3.7 ETHICAL CONSIDERATION APPLICABLE TO PHASE 1

Authorization to conduct the research was sought from Uasin Gishu County and the Ministry of Higher Education, Science and Technology in Kenya.

Letters of information were written to individual school heads explaining who the researcher is, the study's title and purpose, and participants' voluntary participation. Interviews were conducted in a setting that ensured privacy and confidentiality. Moreover, there was no identifier on checklists. The participants were not coerced into participating. The letter of information explained how the research was conducted,

whether there were any risks or discomfort to participants, and that participants could withdraw from the study at any time. Information on whether there were any benefits or remuneration for participating in the research was also provided. The consent was given by the participants in writing.

PHASE 2

3.8 PHASE 2: TO DEVELOP AN APPROPRIATE INTERVENTION FOR WASH IN PRIMARY SCHOOLS IN UASIN GISHU COUNTY, KENYA

The objective of phase 2 of the research study was to develop an appropriate WASH intervention for primary schools in Uasin Gishu County, Kenya. This objective was to be achieved by answering the following questions: who should be involved in implementing the WASH program in primary schools, what should be included in its implementation, and how the WASH program should be implemented in primary schools in Uasin Gishu County, Kenya.

3.8.1 RESEARCH DESIGN

A consensus approach employing the Delphi technique was implemented during this phase of the study. The Delphi method is a systematic framework for group communication, facilitating collaboration among a panel of experts to address complex issues and formulate well-informed solutions (Fawole *et al.* 2018). The process begins by questioning a group of experts on their judgment and opinions on a particular topic through a questionnaire or interview schedule, and their judgment or views are assessed; then they are given the opportunity to revise their views. This process continues until consensus is arrived at (Okoli and Pawlowski 2004).

Rowe and Wright (1999) state that the Delphi technique lets experts share opinions privately, preventing confrontation and social pressure. In this study, experts on school WASH programs from various sub-counties and the county, including school head teachers, participated. The Delphi technique was suitable because each expert could give their opinion freely and privately, without meeting as a group. Table 6

summarizes the research design and methodology used to address objective 2, which is creating a suitable WASH intervention for primary schools in Uasin Gishu County, Kenya.

Table 6: An overview of the research design and methods of phase 2

Phase 2					
Research objective 2	Study design	population and sampling	Data collection	Trustworthiness	Data analysis
Phase 2 (iii) To develop an appropriate intervention for WASH in primary schools in Uasin Gishu County, Kenya.	Consensus method-Delphi technique Round 1	School head teachers and School WASH panel of experts: the County Educational officer, the schools' Boards of Management (BOM), the county in-charge of water department, the county director of health, the county public works officer, the Kenya Institute of Curriculum Development officer, and representatives of non-governmental organizations	Delphi round 1: an interview schedule	School WASH Panel of experts from different fields. Ensuring anonymity of the participants Verbatim quotes will be used to support the findings	Deductive coding and pattern marching approaches: Screening and synthesize of data, categorization of common themes, Pattern matching
	Round 2	Head teachers and School WASH Panel of experts above	Delphi round 2: structured questionnaire	Validation of their response in round 1	Descriptive and consensus analysis technique: Degree of agreement or disagreement Categorization of agreements

3.8.2 SAMPLING

3.8.2.1 Selection of the panel of experts (key informants)

An expert is defined as a person with relevant knowledge of and experience in the school WASH program. These experts were identified by their roles and responsibilities in school WASH as outlined in the Kenya School Health implementation guidelines (Ministry of Education and Health, 2018). The following categories of experts were identified: the school head teachers, the County Educational directors, the schools' Boards of Management (BOM), the county in charge of the water department, public health officers, the county public works officer, quality assurance and standards officers, and representatives of non-governmental organizations/ development partners participating in WASH activities in Uasin Gishu County.

3.8.2.2 Sample size

County management officials in charge of the school health program in Uasin Gishu County, and any other organization participating in WASH activities in the county, were purposively selected because the researcher was specifically interested in only those who participate in the WASH program. At the county and in each Sub-County, there are a few specific personnel in the department of public health in charge of the WASH program in schools engaged in WASH activities. All the personnel were involved in the study.

It is generally recommended that a Delphi panel include 10 to 18 experts. However, the size is not based on statistical power but on the need for effective interaction and consensus (Okoli and Pawlowski 2004). In this study, only personnel involved in WASH activities in the county were included, most of whom are government employees.

Head teachers were also purposively sampled, as they are responsible for managing the WASH program in schools.

3.8.3 DATA COLLECTION METHODS AND INSTRUMENTS

Data collection in Phase 2 was conducted using the Delphi consensus technique, which involved two sequential and iterative rounds of engagement with a purposively selected panel of school WASH experts. The process was designed to systematically elicit expert opinions, refine areas of agreement, and develop consensus on the most appropriate WASH intervention for public primary schools in Uasin Gishu County.

3.8.3.1 Delphi Round I: Exploratory data collection

Delphi Round One focused on the exploration of expert views and experiences regarding school WASH program implementation. Identified experts were contacted individually and invited to participate. Each participant received an information sheet and consent form outlining the purpose of the study, the Delphi process, expectations for participation, and ethical considerations. Only experts who provided written informed consent were included in the study.

Data were collected using an unstructured interview schedule, which provided flexibility and allowed participants to freely express their views without constraints imposed by predetermined response options. This approach is consistent with the exploratory nature of the first Delphi round and is recommended for capturing diverse expert perspectives on complex issues (Rowe and Wright 1999).

The unstructured interview schedule was used to gather information from head teachers, the government officials in charge of WASH at the county level, and other stakeholders / non-governmental organizations engaged in WASH program activities in Uasin Gishu County. The construction of the interview schedule was guided by the input component of the school WASH conceptual framework applied in this study and appropriate research questions. The interview schedule addressed the following key areas:

- Planning and coordination of school WASH programs
- Financing and budgeting for WASH interventions
- Roles and responsibilities of stakeholders involved in WASH
- Implementation strategies at school, sub-county, and county levels
- Monitoring and evaluation mechanisms for school WASH programs

- Gaps, challenges, and proposed strategies for strengthening WASH implementation in primary schools

The Key Informant Interview (KII) was audio-recorded; the interview lasted approximately 30-40 minutes. The interviewing of participants continued until no new information was gathered; that is, when data collection stopped. This is referred to as the point of data saturation (Hennink, Kaiser, and Marconi 2017).

3.8.3.2 Delphi Round Two: Validation and Consensus Building

Delphi Round Two aimed to validate, refine, and prioritize findings from Round One and to establish consensus among the panel of experts. Based on the analysis of Round One data, a structured questionnaire was developed. The questionnaire contained clearly defined statements representing the synthesized themes and proposed components of an appropriate school WASH intervention.

Participants were asked to indicate their level of agreement or disagreement with each statement, typically using a Likert-type scale. This round enabled experts to reconsider their earlier views in light of aggregated group responses while maintaining anonymity. The structured format facilitated systematic comparison of responses and identification of areas of convergence and divergence.

Controlled feedback was provided to participants by summarizing the collective responses from Round One without attributing views to individual experts. This feedback mechanism encouraged reflection and enhanced the credibility of the consensus-building process.

3.8.4 DATA ANALYSIS

3.8.4.1 Analysis of Delphi Round One Data

Audio-recorded interviews from Round One were transcribed verbatim into Microsoft Word to ensure accuracy and preserve participants' original expressions. The transcripts were then imported into NVivo version 12 for qualitative data management and analysis.

A deductive coding approach was used, informed by:

- The study objectives

- The interview guide
- The WASH conceptual framework

An initial coding framework was developed prior to analysis and systematically applied across all transcripts. Similar codes were clustered into categories, and related categories were merged to form broader themes. This process involved:

- Screening and familiarization with the data
- Identification of meaningful units of text
- Categorization of responses based on similarity of meaning
- Pattern matching across participant responses

The resulting themes captured expert consensus on key elements of WASH intervention design, including governance structures, stakeholder roles, implementation mechanisms, resource requirements, and monitoring strategies. Verbatim quotations were retained to support credibility and provide illustrative evidence of expert perspectives.

3.8.4.2 Analysis of Delphi Round Two Data

Data from Round Two were analyzed using descriptive and consensus analysis techniques. Responses were summarized to determine the degree of agreement or disagreement for each statement derived from Round One themes.

Consensus was assessed through:

- Frequency distributions of responses
- Percentage levels of agreement across the expert panel
- Categorization of statements into agreed, partially agreed, or disputed items

Statements achieving high levels of agreement were retained as core components of the proposed WASH intervention framework. Items with lower levels of agreement were reviewed and either refined, merged with related components, or excluded based on expert feedback.

The results of Round Two analysis culminated in a validated and expert-driven intervention framework for WASH implementation in primary schools in Uasin Gishu County.

3.8.5 RESEARCH CONSIDERATIONS APPLICABLE TO PHASE 2

Participants in the Delphi study and broader research received information sheets and consent letters. They were told participation was voluntary, withdrawal had no consequences, and confidentiality and anonymity were ensured. Written informed consent was obtained from all who joined the study.

PHASE 3

3.9 PHASE 3: TO CONDUCT SHORT-TERM OUTCOME EVALUATION OF THE NEWLY DEVELOPED INTERVENTION FOR WASH IN PRIMARY SCHOOLS IN UASIN GISHU COUNTY, KENYA

The main objective of this phase of the study was to conduct a short-term outcome evaluation of the developed interventions from the perspectives of the school WASH experts to determine whether the interventions were acceptable and feasible for the WASH program in primary schools in Uasin Gishu County, Kenya. This objective was achieved by answering the following research questions: What are your views on the proposed intervention in schools, how can this proposed intervention be effectively implemented, who should be involved in the implementation of the proposed intervention (the stakeholders), what are some of the barriers that can hinder implementation of the intervention in school and what are some of the facilitators to implementation of the proposed intervention in schools.

3.9.1 RESEARCH DESIGN

In this phase, the researcher used a qualitative approach to assess the feasibility and acceptability of the developed intervention. The aim was to understand users' views on the proposed intervention, refine it, identify barriers and facilitators, and determine whether it can be effectively rolled out across all schools. The overview of the research design in this phase is illustrated in Table 7.

Table 7: An overview of the research design and methods of phase 2

Phase 3					
Research objective 4	Study design	Population and sampling	Data collection	Trustworthiness	Data analysis
(iv) To validate the feasibility and acceptance of the newly developed intervention by the experts involved in WASH in public primary schools in Uasin Gishu County, Kenya.	Qualitative research design	School WASH panel of experts: The Sub-County Education directors, County officer in-charge of water department, County public works officer public health officers, quality assurance and standards officers, constituency development funds officer, school head teachers and school board of Management	Semi-structured interview and Field notes taking	Validity and reliability Use of valid and reliable instruments	Direct data interpretation. Editing style

3.9.2 POPULATION AND SAMPLING TECHNIQUES

3.9.2.1 Study population

The study population in this phase will comprise the head teachers and employees of the Sub-County and County governments of Uasin Gishu who are engaged in or in charge of School WASH. These participants must have participated in Phase 2 of the study.

3.9.2.2 Sampling

For this phase, the researcher used purposive sampling, focusing on participants in the county's school WASH program who had also participated in Phase 2. These experts had already shared their views on needed interventions to promote WASH activities in schools.

3.9.3 DATA COLLECTION METHODS AND INSTRUMENTS

During the third phase of the study, the researcher held a workshop bringing together all the experts from phase two to collect their input as the intended users of the new intervention. Semi-structured interviews and field note taking were used to gather their feedback. The experts included the Sub-County Education directors, the County officer in charge of the water department, the County public works officer, public health officers, quality assurance and standards officers, the constituency development funds officer, school boards of management, and head teachers from the selected schools in the six sub-counties. The researcher developed an appropriate intervention based on the findings from the Delphi technique and the critical analysis conducted in Phase 1. The researcher then presented the proposed intervention to WASH experts as end users to gather their views and determine the acceptability and feasibility of the developed intervention.

Experts were contacted in advance to inform them about the workshop and request their participation. They were also asked to choose a suitable day for the workshop. A draft of the intervention was then emailed so they could review it and prepare feedback before the presentation.

Questions addressed during the presentation of the proposed intervention workshop

- What are your views on the proposed interventions in schools?
- How can this proposed intervention be effectively implemented?
- Who should be involved in the implementation of the proposed intervention -- the stakeholders?
- What are some of the barriers that can hinder implementation of the intervention in school?
- What are some of the facilitators of this intervention in schools?

3.9.3.1. Data quality

To ensure data quality, qualitative methods were used to collect information on the school WASH intervention being developed. Respondents were given feedback on the collected information so they could review and provide input.

3.9.4 DATA ANALYSIS

In this Phase 3 of the study data was analyzed using direct data interpretation. According to (Mchunu 2007), direct data interpretation is supported in case study research. This involves looking at a single instance of feedback obtained from efficacy and effectiveness testing and drawing meaning from it. Editing style of data analysis was utilized. This process was about the researcher searching for meaningful segments of data collected that related to the questions asked in the pilot testing and efficacy and effectiveness testing (Stake 1995). The researcher then sorted and organized the data into related categories.

3.9.5 RESEARCH CONSIDERATIONS APPLICABLE TO PHASE 3

Consent forms were distributed to teachers, head teachers, and experts invited to contribute to the development, implementation, and evaluation of the proposed intervention. Participants were clearly informed that their involvement was voluntary and that they could withdraw from the study at any stage. They were also assured that all information provided would be treated with strict confidentiality and that their identities would remain anonymous. Written informed consent was obtained from all individuals who agreed to take part in the research.

3.9.6 DATA MANAGEMENT

Following data collection, all recorded information was securely stored in a password-protected folder on a computer accessible only to the researcher. During data analysis and transcription, the audio recording was played through a device with earphones, ensuring only the researcher could hear it. The data will be securely stored in the Faculty of Health Sciences for a period of 5 years, after which it will be destroyed in accordance with Durban University of Technology policy

3.9.7 ETHICAL CONSIDERATIONS

Ethical approval for the study was obtained from the Durban University of Technology Institutional Research Ethics Committee (IREC). Permission to conduct the research in Kenya was subsequently sought from the Ministry of Higher Education, Science and Technology, as well as from the County Director of Education in Uasin Gishu County for access to primary schools. The research proposal was also reviewed and approved by the Institutional Research Ethics Committee at the University of Eastern Africa, Baraton. Following this approval, the study was submitted to the National Commission for Science, Technology, and Innovation (NACOSTI) for licensure. Upon receiving NACOSTI clearance, the licensure letter was presented to the relevant authorities in Uasin Gishu County, resulting in clearance from both the County Commissioner's office and the Director of Education.

Letters of information were provided to WASH officials, school heads, and teachers, outlining the researcher's identity, the title and purpose of the study, and the voluntary nature of participation. These letters also described the study procedures, potential risks or discomforts, participants' right to withdraw at any time, and any benefits or remuneration associated with participation. Interviews were conducted in private settings to ensure confidentiality, and no personal identifiers were included in interview recordings or observation checklists. Participation was entirely voluntary, with no coercion involved.
School head teachers and WASH experts were informed that the final phase of the study would involve a small number of selected schools participating in a feasibility and acceptability workshop aimed at identifying strategies to improve WASH programs in schools. Participation in this phase was also voluntary.

Written informed consent was obtained from teachers, head teachers, and WASH experts prior to data collection. Participants were assured of confidentiality and anonymity and informed of their right to withdraw without penalty. All data will be stored securely within the Faculty of Health Sciences for a

period of five years, after which it will be destroyed in accordance with Durban University of Technology policy.

Connecting text

The previous chapters which were chapter 1-3 presented background information of the research study, literature review and research methodology. The following chapters present research results. The results are presented in the form of research articles already published and manuscripts submitted or prepared for submission. The chapters are chapter 4 to chapter 8. The next presented chapter is chapter 4 which consists of research results of objective number 2 which was to conduct a critical analysis of WASH interventions in primary schools in Uasin Gishu County, Kenya. Objective number 2 constituted PHASE 1B of the study.

4.0 CHAPTER 4: PRESENTATION OF RESEARCH RESULTS

Chapter 4 shares the research results and discusses findings for objective 1, which was to map evidence on WASH interventions in primary schools in low- and middle-income countries. This was done through a scoping review, and the results were published in the *Journal for Water, Sanitation and Hygiene for Development* as phase 1A of the study

PHASE 1B:

This chapter presented the research findings of objective number 2. Objective (2) was to be achieved by answering questions about the inputs, activities, and outcomes of the WASH program implementation in primary schools in Uasin Gishu County. The research findings are presented in the form of Manuscripts 1 and 2. Manuscript 3 is a paper presenting the results of a document analysis conducted as part of supplementary data to meet research objective number 2.

Manuscript 1 presents research findings on the activities and outcomes of WASH interventions in primary schools in Uasin Gishu County. The research results are already published in the *BMC Public Health.* Volume 26, Article number 739, 30th January, 2026

4.1: PULICATION TWO: ASSESSMENT OF WATER, SANITATION AND HYGIENE INTERVENTIONS IN PRIMARY SCHOOLS: A CASE STUDY OF UASIN GISHU COUNTY,

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RESEARCH Open Access

Assessment of water, sanitation and hygiene interventions in primary schools: a case study of Uasin Gishu County, Kenya

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Abstract

Background Access to safe water, sanitation and hygiene (WASH) in schools is essential for children's health, wellbeing and learning. However, data on school WASH in Kenya remain limited. This study aimed to assess the availability, functionality, and management of water, sanitation, and hygiene (WASH) interventions in primary schools in Uasin Gishu County to inform policy and practice.

Methods A mixed-methods case study was conducted in 51 proportionally sampled primary schools (24 rural, 27 urban) out of 498 in the county. Quantitative data were collected using structured questionnaires and observation checklists administered to head teachers or their representatives. Qualitative data were obtained through focus group discussions (FGDs) with teachers. Descriptive statistics were generated in R; qualitative data were thematically analyzed in NVivo.

Results The mean school population was 586 pupils. 61% (61%) of schools had access to piped water; 49% (49%) of schools relied on protected wells, and 24% (24%) of schools collected rainwater. Many schools used multiple water sources, so these percentages were not mutually exclusive. 73% (73%) of the schools lacked disability-friendly infrastructure for water supply access points. Median pupil toilet cubicles were 18 [IQR: 14–22]; 98% (98%) of schools had separate staff and pupil toilets. Two-thirds, 67% (67%) of schools reported availability of water for hand washing throughout the day, yet 59% (59%) of the schools lacked soap at hand washing points. Three-quarters, 75% (75%) of schools provided menstrual products. However, only 22% (22%) of schools had changing rooms and 25% (25%) of schools had sanitary disposal facilities. A WASH policy document was absent in 67% (67%) of the schools. Private schools generally showed better operation and maintenance indicators of WASH interventions than public schools.

Conclusions WASH interventions in the surveyed schools were inadequate and unevenly distributed, with notable gaps in disability inclusion, menstrual hygiene management and policy implementation. Strengthening routine water quality testing, upgrading sanitation infrastructure, ensuring soap availability, and implementing inclusive WASH and menstrual hygiene policies can significantly improve pupil health, reduce disease transmission, and promote equity in educational settings.

Keywords Water, Sanitation, Hygiene, Schools, Interventions, WASH

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Background

Water, sanitation, and hygiene (WASH) interventions are critical for preventing and controlling infectious diseases, including gastrointestinal illnesses and respiratory infections, particularly in school environments where children spend considerable time in close contact [1, 2]. International commitments such as the United Nations' recognition of water and sanitation as a human right and Sustainable Development Goal (SDG) 6 underscore the need for universal access to safely managed WASH services [3, 4].

Compared to all other regions, Africa has millions more children without access to these services in school (10). Despite monitoring efforts by the WHO/UNICEF Joint Monitoring Programme, granular, county-level data from Kenya remain scarce [5, 6]. Following the COVID-19 pandemic and the implementation of school reopening guidelines, there is an urgent need to assess and benchmark WASH services in schools to inform targeted investments and policy actions [7, 8]. Investing in core public health infrastructure, such as water supply and sanitation systems, is one of the most cost-effective strategies for pandemic preparedness, particularly in resource-constrained contexts [7–9].

WASH interventions have been categorized into three, including Water interventions, sanitation interventions and Hygiene interventions [10], they are explained as follows. Water interventions are categorized as those facilities and activities established in primary schools to promote water availability and quality, these interventions may include; any intervention to assess water quality and facilities, to provide a new and/or improve water supply or distribution system, or both, the intervention that would reduce directly and indirectly exposure to water contamination (e.g. installation and extension of piped water supply, boreholes, hand pumps, water trucking or tankers and protection of water resources, interventions to improve quality of drinking water at the source or point of use. Sanitation interventions in primary schools are categorized as; those facilities and activities established in schools for safe disposal and management of human waste; interventions carried out to assess sanitation facilities, introduce, improve or expand the coverage of sanitary facilities for safe management, disposal and treatment of excreta. The facilities include, improved and unimproved toilets, sewerage system, septic tank, soak pit and solid waste management facilities.

Hygiene interventions may be categorized as those activities and facilities that are established in schools to promote hygiene practices and promote health. They include: Any intervention that provides hygiene materials or use of hygiene materials (e.g. soap, hygiene kits, and hand washing stands / stations, sinks, menstrual hygiene and other facilities), interventions conducted in schools to reduce and eliminate intestinal parasites and contact diseases/ parasitic infestations of the skin and the scalp, promotion of hygiene behaviors, norms or practices surrounding personal, food and hand hygiene and assessment.

The aim of this study was to assess the availability, functionality, and management of water, sanitation, and hygiene (WASH) interventions in primary schools in Uasin Gishu County, Kenya, using a mixed methods case study approach. Specifically, the study sought to determine the status of WASH infrastructure and services, identify gaps in operation and maintenance, examine the extent of hygiene promotion and menstrual hygiene management in schools, and generate evidence to inform policy and practice for improving school WASH conditions.

Methodology

Study Design, population and setting

The study employed a case study design integrating both quantitative and qualitative approaches to explore the interventions of Water, Sanitation, and Hygiene (WASH) in primary schools with mixed methods. Case study is defined as an in-depth investigation of a single case (individual, group, organization, events, community, or geographic area) or multiple cases to understand complex issues in context. Case studies often use mixed methods (e.g., interviews, observations, documents, surveys) to triangulate findings and provide a holistic view.

This study adopted a case study design to provide an in-depth understanding of water, sanitation, and hygiene (WASH) interventions within a bounded context, in this case, the primary schools in Uasin Gishu County, Kenya. Since case studies employ mixed methods, this approach was also employed in this study, combining quantitative and qualitative techniques to capture both measurable indicators and contextual insights. The case study approach was appropriate because it enabled a comprehensive examination of complex WASH-related issues within their natural context.

The setting was Uasin Gishu County in Kenya's Rift Valley region. The study population comprised 498 registered primary schools across six sub-counties (Soi, Moiben, Kesses, Turbo, Kapseret, and Ainabkoi). The county with its 498 schools was selected due to its active participation in school-based WASH programs under the national school health initiative.

Sampling and sample size calculation of primary schools in Uasin Gishu

As part of a case study, proportional sampling was used to determine the number of public primary sample to be included, the sampling method was used that school selected from each sub-county was proportional to the

representation of the strata in the total population of schools.

The sample size for each sub-county was calculated based on the proportion of schools it contributes to the total number of schools in Uasin Gishu (N = 498). Schools were then conveniently sampled from urban and rural settings to capture the difference in infrastructure [11]. Consequently, the sample included 12 schools from Soi, 9 from Moiben, 9 from Kesses, 8 from Turbo, 6 from Kapseret and 7 from Ainabkoi Sub counties, with 24 rural and 27 urban schools overall. Figure 1 shows the map of the 6 sub-counties in Uasin Gishu County.

Eligibility criteria were defined to enhance comparability across schools. Public and private schools were eligible if they were officially recognized by the ministry of education, enrolled both genders, either day or boarding, and had a candidate class preparing for Kenya certificate of Participants.

Head teachers or their representatives participated in the survey. In addition, 10–15 teachers were conveniently selected from schools in three randomly chosen sub-counties for FGDs.

Data collection methods and instruments

Data for this study were collected using a mixed methods approach that combined quantitative and qualitative techniques to capture both measurable indicators and contextual insights on WASH conditions in primary schools. Quantitative data were gathered through survey using an interviewer-assisted structured questionnaire administered to head teachers or their representatives. This questionnaire captured information on water supply sources, sanitation facilities, handwashing infrastructure, menstrual hygiene management, and WASH-related policies. To complement the self-reported information, an observation checklist was used to directly assess the physical condition, functionality, and adequacy of WASH facilities such as water points, toilets, handwashing stations, and kitchen hygiene structures. Both instruments were digitized and deployed using the CommCare mobile platform, which incorporated built-in quality checks and allowed for consistent offline or online data capture.

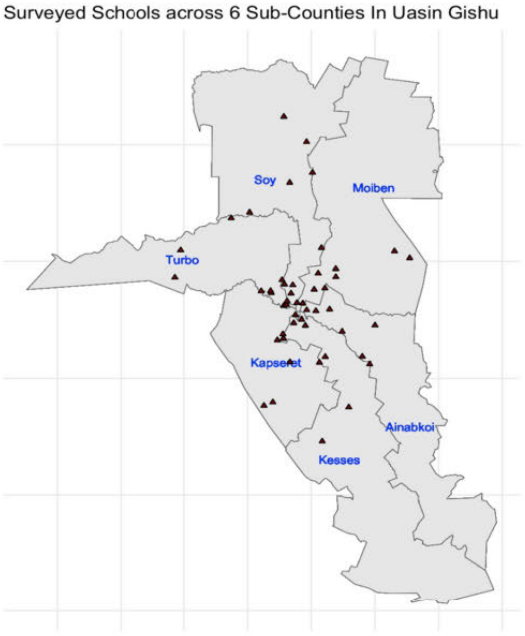


Fig. 1 Surveyed Schools in Uasin Gishu

Qualitative data were collected through semi-structured focus group discussions (FGDs) involving groups of 10–15 teachers in selected schools. The FGD guide explored teachers' experiences with WASH implementation, their roles in hygiene promotion, perceived adequacy of facilities, challenges in water and sanitation management, and views on menstrual hygiene support. Discussions were facilitated by trained moderators, recorded with permission, and later transcribed for thematic analysis.

All instruments were piloted prior to the main data collection to refine clarity, ensure relevance, and test the technical functionality of the CommCare system. Data collectors received training on ethical conduct, confidentiality, and standardized administration of the tools, ensuring consistency and reliability throughout the process.

Data analysis

Quantitative data collected through CommCare were exported to Microsoft Excel for initial cleaning and validation. Cleaning involved checking for completeness, consistency, and removal of duplicate entries. Missing values were addressed by cross-verifying with original data sources where possible. After cleaning, the dataset was imported into R for statistical analysis. Descriptive statistics were computed, including frequencies, percentages, means, medians, and interquartile ranges (IQR). Subgroup comparisons were conducted to explore differences between urban vs. rural schools and public vs. private schools. Results were presented using tables and figures for clarity.

Qualitative FGD data were transcribed by trained transcribers and thematically analyzed in NVivo 15, identifying and interpreting emergent themes.

Qualitative data from Focus Group Discussions (FGDs) were audio-recorded, transcribed verbatim, and verified for accuracy by trained transcribers. Thematic analysis was employed following Braun and Clarke's six-step framework which includes: Familiarization with data,

this is where there was repeated reading of transcripts to gain an in-depth understanding, followed by generating initial codes which was done using NVivo 15 software to identify meaningful units of text, this was also followed by searching for themes; codes were grouped into broader categories reflecting patterns in the data and themes were refined by comparing across transcripts and ensuring internal coherence. Thereafter, clear definitions were developed for each theme to capture its essence and production of the report done using illustrative quotes to support interpretation and ensure credibility.

Ethical approval and consent to participate

This study was conducted in accordance with the ethical principles outlined in the *Declaration of Helsinki* for research involving human participants. Ethical clearance was obtained from the Institutional Research Ethics Committee (IREC) of the Durban University of Technology, South Africa, and from the Ethical Review Committee of the University of Eastern Africa, Baraton, Kenya. Additional authorization to conduct the study in Kenya was granted by the Ministry of Education in Uasin Gishu County and the National Commission for Science, Technology and Innovation (NACOSTI). IREC Ethical Clearance number was (IREC 113/23).

All participants were informed about the purpose, procedures, potential risks, and benefits of the study prior to their involvement. Written informed consent was obtained from each participant before data collection. Participation was voluntary, and individuals were assured of their right to withdraw from the study at any time without penalty. Confidentiality and anonymity were maintained by avoiding the collection of personal identifiers and by securely storing all data accessible only to the research team. No clinical interventions were undertaken as part of this research.



Fig. 2 portable plastic water container for drinking water in schools

Results

Primary school's characteristics

Of the 51 schools, 24 schools were in rural areas and 27 schools were in urban areas. Ten (10) out of all the schools were private while forty-one (41) were public schools. Respondents of the study were head teachers in 51% (51.0%) of the schools, deputy head teachers accounted for 33% (33%), senior teachers were twelve (12%) percent of the schools, and 4% (4%) of the schools were represented by the WASH leads as respondents of the study. The average school population was 586 pupils (range: 106–2256). Urban public schools had larger enrolments (mean 852) than rural public schools (mean 369). The youngest pupils averaged 5 years; the oldest averaged 15–17 years. The average number of teachers per school was 24 and non-teaching staff 7, with more staff in urban than rural schools.

It is important to note that some of the questions in the questionnaire and checklist used for data collection had multiple responses, these therefore means that some percentages were not mutually exclusive.

Water interventions

The majority of schools had access to multiple sources of safe water: 61% (61%) of the schools used piped water, 49% (49%) of schools used protected wells, and 24% (24%) of schools collected rainwater, while three-point 9% (3.9%) schools relied on tanker-truck deliveries. No schools used surface water or unprotected springs. Most schools at 98% (98%) used plastic storage tanks; some also used portable containers. Private schools had more drinking water points (median 8) than public (median 4). While 98% (98%) of the schools reported protected sources and 90% (90%) of the schools had flowing taps, and 28% (28%) of schools noted tap leakages. There was crowding at water points that was observed in thirty-seven-point 3% (37.3%) of schools, indicating insufficient points. Infrastructure for pupils with disabilities was inadequate in 73% (73%) of the schools, with barriers including distance, terrain, and tap/pump usability. Figure 2 is an example of drinking water storage containers available in schools in Uasin Gishu County.

A good number of schools reported external providers. 58% (58%) of the schools reported external provider as their primary source of drinking water; however a significant number relied on school-owned systems in 41% (41%) of the schools. Overall, 84% point three (84.3%) schools reported functional supply meeting needs, though 8% (8%) of public schools reported insufficiency. Water quality testing was limited: 22% (22%) of schools had never tested on-site; 48% (48%) tested within the past year; 14% (14%) of schools tested more than two years prior. Among those tested, eighty-one point 6% (81.6%) reported compliant results. Chlorination was

the predominant treatment method in 94% (94%) of the schools, with a few schools using filtration or boiling. FGD participants also highlighted uncertainty around water treatment practices. One teacher explained that even with chlorination they could not be sure of the water safety as they lacked guidance on the correct quantities to add.

> *"Although we are also placing tablets in this water. We are not sure of the measure, whether the water is clean or maybe we are putting less. So, we're not sure of the quality" FGD TEA 03-R6.*

Sanitation interventions

Median pupil toilet cubicles were 18 [IQR: 14–22], higher in private schools (median 20) than public (median 16). All schools had gender-segregated toilets; 98% (98%) of schools had separate staff toilets. The majority of the schools in Uasin Gishu county had pit latrine as a type of sanitary facility for disposal of human waste at 69% (69%). A few schools had flush toilet either connected to the septic tank or sewer system.

Many schools according to FGD discussion had pit latrines and only a few schools had flush toilets. The respondents reported a concern about the pit latrines being filled up within a short period.

> *"Yeah, it's a, a concern, especially for our case. We're considering that we have more learners in school so that is the biggest worry, especially in the pit latrines. So, within a few months it's already filled up" FGD TEA 03-R3.*

Unresolved toilet functionality issues were reported during the time of data collection in nineteen point 6% (19.6%) of schools which were all public schools.

When it comes to cleaning frequency of the toilets, the toilets were cleaned once daily in 58% (58.8%) of schools; private schools were cleaned twice daily or as needed. Most toilets were located outside the school building but built within school compounds in 61% (61%) of the schools.

FGD also revealed that some schools made infrastructure adjustments such as ramps and special toilets for children with mobility challenges. As one participant explained,

> *"For us, we have the ramps. Yes. The ramps for those with special needs. . Even the toilets have their special toilet for the girls, but not for the boys. So, the boy child is like, (Laugh) … is forgotten" FGD TEA 02-R6.*

Additionally, it was also observed that disability adaptations had been done in some schools, this adaptation included widened entrances in 47% (47%) of the schools, increased internal space in 31% (31%) of the schools, and adapted door handles done in 24% (24%) on the school. Toilet cleanliness was suboptimal: 74% (73%) of the toilets were not clean; feces/urine presence and odors were common. 27% (27%) of the toilets were clean. Private schools showed better operation and maintenance than public schools as shown in Fig. 3.

FGD interview revealed that toilet facilities were inadequate, particularly in urban schools where pupils were often observed queuing to use them.

> *"It's not adequate because as now, these town schools have more pupils so, and the toilets there, the latrines are not adequate". (crosstalk) FGD TEA 03-R3.*
>
> *"Okay. To me, it's inadequate because when you see the girls or the boys, they always queue" (Agreement across the room) FGD TEA 03-R6.*

Hygiene and menstrual hygiene management interventions

Most schools had running water for hand washing at 71% (71%). Water for hand washing was stored in plastic containers with taps as an outlet, this was revealed in 63% (63%) of schools. The challenges of hand washing facilities included broken or missing faucets in 27% (27%) of schools, water shortages reported in 22% (22%) of the schools, drainage problems reported in 10% (10%) of the schools, and clogged or damaged sinks. Although 66% (66.7%) of schools reported water availability throughout the day for hand washing, 59% (59%) of schools lacked soap at hand washing points. MHM education was reported in all schools; menstrual products were available in 80% (80%), often on request. However, only twenty two (22%) of schools had changing rooms and only 25% (25%) of schools had disposal facilities.

FGD confirmed the gaps in private changing spaces and sanitary disposal facilities in school. Teachers reported that girls often disposed of used sanitary towels in the toilets instead of sanitary bins and lacked appropriate changing spaces. One participant explained,

> *"In our school, we have the sanitary pads, managing the girls on a monthly basis they're given, and then they're taught how to use them. And after using they dispose in the bins and then they put in in the latrines" FGD TEA 03-R5.*

Another emphasized the need for better facilities, "*We have a problem with changing rooms for the girls. It is so… it's not in order for these girls to be changing in these*

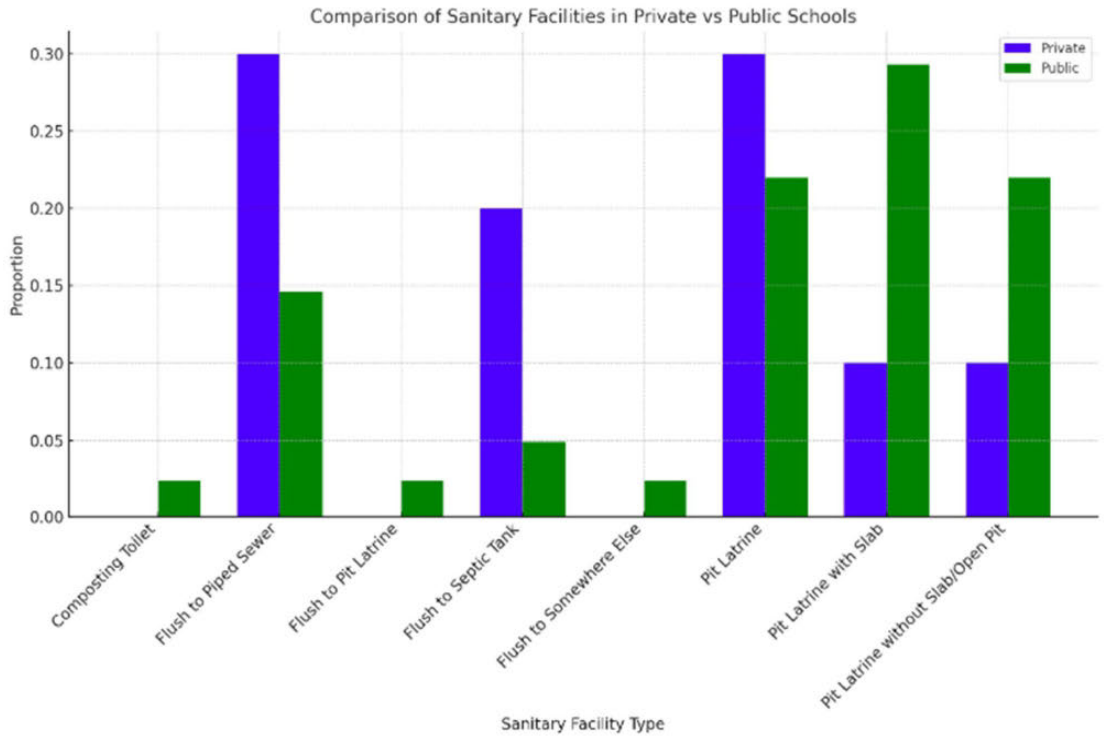


Fig. 3 Sanitary Facilities between private and public schools

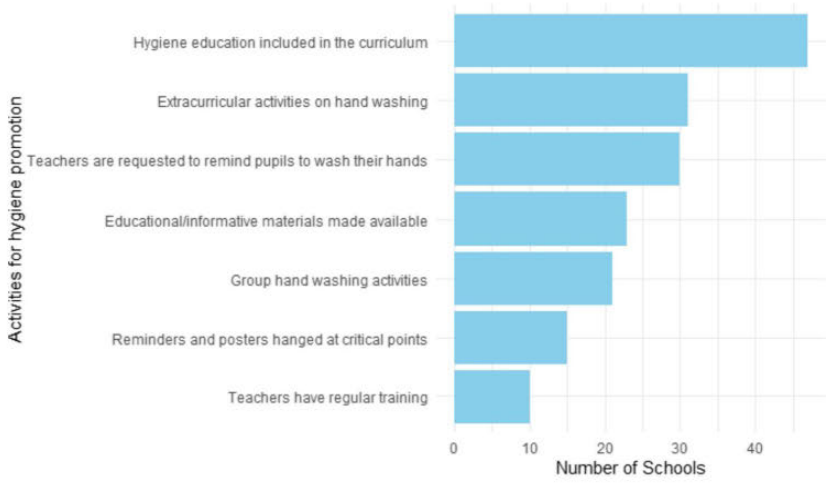


Fig. 4 Number of schools with various activities of hygiene promotion

toilets that are not clean, because this, you have to take some time. Have to at times it is water logged… we would like to ask through you, if there is a place where the government can have a changing room for the girls" FGD TEA 01-R4.

There were minimal reminders and posters on hand hygiene promotion at critical points in schools and also minimal training of teachers on hygiene promotion activities. It is worth noting that hygiene education is included in the curriculum in all schools in Uasin Gishu county as indicated in Fig. 4.

Table 1 Evidence of WASH documents and WASH policy

	Total (*N* = 51)	private (*N* = 10)	public (*N* = 41)
Is there a copy of WASH policy			
No	34 (66.7%)	7 (70.0%)	27 (65.9%)
Yes	17 (33.3%)	3 (30.0%)	14 (34.1%)
Other Evidence			
Department responsible for wash activity	29 (57%)	5 (50%)	24 (59%)
Hygiene education Department	35 (69%)	7 (70%)	28 (68%)
Sanitation education Department	25 (49%)	5 (50%)	20 (49%)

Food hygiene and kitchen interventions in primary schools in Uasin Gishu County

Most schools ninety-four-point 1% (94.1%) had kitchens; running water was present in 90% (90%) of private and 53% (53.8%) of public-school kitchens. Two-thirds of the schools had washable floors and half had washable worktops. Storage facilities were inadequate in some public schools. The median number of kitchen employees was two, with higher staffing and more valid food handler certificates in private schools compared to public schools. FGDs indicated some food handlers lacked certification, with hiring based on experience not training on food handling.

Policy documents and WASH governance

A WASH policy document was absent in sixty six point 7% (66.7%) of schools across both private and public sectors. This lack of policy guidance may pose challenges in effective implementation of WASH interventions in primary schools. However, an average number of schools across both categories of public and private primary schools had a department responsible for WASH activities as shown in Table one (Table 1).

Discussion

Summary of principal findings in primary schools in Uasin Gishu County

The study identified substantial gaps in WASH service interventions availability and quality, including insufficient water points, limited water quality testing, inadequate disability inclusion, toilet cleanliness and adequacy challenges, soap shortages at hand-washing stations, and inadequate MHM infrastructure. Private schools generally performed better on operation and maintenance indicators than did public schools, hence reflecting resource disparities.

Water interventions in primary schools in Uasin Gishu County

Availability of safe water in school immensely contributes to the realization of the right to education. If school authorities lack the capacity to provide safe drinking water, children's learning can be greatly compromised due to the increased risk of contracting water borne diseases and exposing learners to adverse effects of excess minerals and metals in contaminated water [12].

According to [13], many countries are compromised in terms of water quality and supply due to lack of WASH infrastructure. A study in Bangladesh evaluated the quality of drinking water in schools and reported lower levels of water treatment at 26% (26%) of 38 schools included in the study [14]. Similarly, a systematic review conducted in Mozambique and Uganda reported that 10% (10%) and seventeen% (17%) of schools respectively treated their drinking water [15]. Furthermore, in another study conducted in Ethiopia, out of 5 schools, 3 practiced water disinfection treatment [16].

World Health Organization developed guidelines for drinking water quality with the purpose to protecting public health. The guidelines provide recommendations for managing the risk from hazards that may compromise the safety of drinking-water. Water quality testing involves analysis of water, which assesses microbiological, chemical, and physical properties [17]. Routine testing of the quality of drinking water sources is therefore recommended to comply with WHO guidelines for drinking water quality and appropriate measures taken to make water safe in schools and other institutions [12, 18].

According to these research findings, a good number of schools at 73% (73%) did not have appropriate infrastructure to support children with disability to access water access points. There are similar findings from a qualitative assessment of disability friendly water and sanitation facilities in primary schools in Rumpi, Malawi; it was reported that about half, 11 out of 23 students with disabilities described facing problems with accessing drinking water at school [19]. The SDGs recognize equitable and adequate access to WASH in schools for vulnerable and marginalized populations such as persons with disabilities as a major priority for promoting health and wellbeing. Despite the SDGs initiative, access to inclusive WASH services in schools remains a big challenge in many resource-constrained settings [20].

Sanitation interventions in primary schools in Uasin Gishu County

Sanitation facilities are essential for public health; they provide safe and hygienic disposal of human waste. Poor hygiene practices and inadequate sanitary conditions play major roles in the increased burden of communicable diseases within developing countries. Improved sanitary facilities contribute to disease prevention, environmental protection, public health and wellbeing, economic benefits, and sustainable development [6, 21].

Access to clean and functional toilets is important in meeting children's physiological and psychosocial needs in a learning environment [21]. According to [22], a meaningful significant association has been found between toilet cleanliness and toilet use for both boys and girls. The poor quality of school toilets has been reported as an issue in many countries, and it has been related to toilet visit refusal amongst children. Access to the use of clean and safe toilets is considered critical for public health.

The majority of primary schools in Uasin Gishu County; 69% (69%) had pit latrines as a type of sanitary facility for disposal of human waste. Research findings from other studies are comparable to this study finding [23]. According to [24], in their study of a sample of 14 schools in Burkina Faso, all students' and teachers' toilets were pit latrines, except for flush toilets for teachers in two schools. In contrast, a study conducted in Kampala, Uganda with a sample size of 274, reported that most 86% (86%) of the schools used flush toilets [25]. According to [26, 27], for a toilet to be adequate, it should be modern, hygienic, and safe to use.

Hygiene and menstrual hygiene interventions in primary schools in Uasin Gishu County

Provision of adequate hand washing facilities, hand washing materials and good hygiene practices in schools coupled with regular hygiene education will reduce the incidence of infectious diseases and create a healthy school environment [28]. The Kenya WASH in schools strategy 2024–2029 addresses the need for all school compounds to have adequate hand washing facilities and enough water and soap [29].

According to a study conducted in Kazakhstan by [30], absence of soap for hand hygiene was reported in schools included in the study. According to [31] their study also reported that fifty six point 8% (56.8%) of the schools had hand-washing facilities available at school. It is clear that many schools from this study findings and other studies lack soap for hand washing, which according to [32] depicts poor hygiene culture prevalent in the schools.

On hygiene and hygiene promotion in schools, from the research results, 47 schools reported including health hygiene in the curriculum. Similar results were shared in a study conducted by [33] to evaluate the impact of adding hand-hygiene in the curriculum and also having group hand washing stations in schools. The findings deduced that adding hygiene content in the curriculum increased pupils' knowledge which translated into action at the hand washing stations.

Menstrual hygiene management necessitates availability of and access to clean and absorbent menstrual material, privacy, water and soap, and disposal facilities for used menstrual materials [34]. Many studies observed that female students faced various challenges of menstrual hygiene management. A cross-sectional study carried out among 82 schools in Ethiopia reported that only 16% (16%) of the schools dedicated spaces for menstrual hygiene [35]. According to a study conducted in rural schools in Zambia, out of the six schools, only one stocked cotton wool in case of emergencies. The remaining schools provided toilet paper to absorb menstrual blood. Teachers reported that their schools did not have enough funds for menstrual pads [34]. It is commendable that a study reported better activities on MHM in schools; the study revealed that about sixty two point 9% (62.9%) of schools were having proper disposal system for MHM and nineteen point 4% (19.4%) of schools were having covered bins for disposal of menstrual hygiene materials in girls' toilets [36].

In its global effort to enhance equitable participation in learning, Sustainable Development Goals has been at the forefront pushing for school girls to have safe and private spaces while in menstruation [37]. According to [38], when MHM is adequately addressed in schools, girls are empowered to manage their menstruation with dignity and this reduces absenteeism and increases school retention rate. MHM is necessary for good health and quality of life [35].

Food hygiene and kitchen interventions in primary schools

Food safety and hygiene are currently a global health apprehension as a result of increasing food-borne diseases (FBDs) [39]. A cross-sectional study investigated the knowledge and food safety practices of 115 Volunteer Food Handlers (VFHs) participating in 38 school feeding program in Gauteng Province, South Africa. The study findings demonstrated a satisfactory level of safe food handling practices by VFHs and that most of the schools ninety seven point 4% (97.4%) had some form of storage enclosures for food [40]. In another study conducted in Northern Ethiopia on food safety in academic institutions, it was reported that 66% (66%) of food handlers said they would not have regular medical checkups; more than half ; fifty four point 8% (54.8%) of them had not received any training in food safety though 63.3% of the food handlers had work experience greater than or equal to 5 years, while thirty six point 7% (36.7%) of them had less than or equal to 4 years [39]. The Kenya School Health Implementation Policy and Guidelines have provided for guidelines on ensuring food hygiene and safety in primary schools. All food handlers or cooks in schools must wear clean and appropriate gear, be periodically examined and possess medical certificates [41]. The aspect of training on food safety by the food handlers has not been addressed in the Kenya School Health Policy and Guidelines though it would contribute to a reduction in risk of contraction foodborne diseases in schools [42].

states that the reduction of foodborne illnesses depends on the adoption and evaluation of effective food handling procedures in the food service industry specifically in schools.

Recommendations

There should be routine testing of the quality of drinking water sources to comply with WHO guidelines for drinking water quality and appropriate measures taken to make water safe in schools and other institutions.

Modern flush toilets connected to the septic tank or sewerage system are recommended in all schools since they use less water and reduce health risks to fecal-oral contamination and other infectious diseases.

Ministry of Education to ensure that all schools comply with school health policy guidelines by having the appropriate infrastructure to support children with disability and the youngest children access WASH facilities.

Schools adopt and evaluate effective food handling procedures in the food service in order to reduce the risk of contracting foodborne diseases.

Government through the ministry of health and other stakeholders identify the barriers towards effective management of menstrual hygiene management in schools.

Limitations

While this study provides valuable insights into the status of WASH interventions in primary schools in Uasin Gishu County, several limitations should be acknowledged:

Sample size and representativeness: The study included 51 schools out of a total of 498 in the county. Although proportional sampling was applied, the relatively small sample size limits the ability to generalize findings to all schools in Uasin Gishu or other counties in Kenya. Variations in infrastructure, funding, and management practices across regions may result in different WASH conditions.

Study design: Data were collected at a single point in time, which restricts the ability to assess trends or changes in WASH interventions over time. Consequently, causal relationships between WASH interventions and health outcomes cannot be established.

Conclusions

WASH services in primary schools in Uasin Gishu County were inadequate and unevenly distributed, with notable gaps in inclusive access, toilet cleanliness, soap availability, and MHM infrastructure. Strengthening routine water quality testing, upgrading sanitation, ensuring hand washing supplies, and implementing inclusive WASH and MHM policies, supported by training and clear governance, may improve the school environment and reduce disease transmission risks. Future research should include longitudinal follow-up and direct measurement of health outcomes to assess impact.

Abbreviations

FGD	Focus Group Discussions
DUT	Durban University of Technology
SDG	Sustainable Development Goals
WHO	World Health Organization
UNICEF	Unite Nations Children's Fund
MHM	Menstrual Hygiene Management
IQR	Interquartile ranges
IREC	Institutional Research Ethics Committee
NACOSTI	National Commission for Science, Technology and Innovation
WASH	Water Sanitation and Hygiene

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-026-26387-4.

Supplementary Material 1.

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Authors' contributions

GCS conceptualized the study and prepared the draft proposal under the supervision of GGM and MAGN. GCS and GGM contributed to the development of the background as well as designing the study. GCS prepared the manuscript and GGM and MAGN critically reviewed it. GSC participated in accessing library resources and data analysis. All authors (GCS, GGM and MAGN) contributed to the reviewed draft version of the manuscript and approved the final version.

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Data availability

The questionnaire, dataset and other materials used for this study are available from the corresponding author upon request. The data generated or analyzed during this study will also be available at DUT library repository.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki for research involving human participants. Ethical clearance was obtained from the Institutional Research Ethics Committee (IREC) of the Durban University of Technology, South Africa, and from the Ethical Review Committee of the University of Eastern Africa, Baraton, Kenya. Additional authorization to conduct the study in Kenya was granted by the Ministry of Education in Uasin Gishu County and the National Commission for Science, Technology and Innovation (NACOSTI). IREC Ethical Clearance number was (IREC 113/23).

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Consent for publication

The research paper does not contain any individual, personal data in any form. No consent for publication needed. Consent for publication is not applicable.

Competing interests
The authors declare no competing interests.

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Manuscript 2 presented the research findings and discussion of the research objective number 2. The research question asked about the input in schools for the implementation of WASH program in primary schools in Uasin Gishu County. The Manuscript was submitted to the *Journal of Water, Sanitation and Hygiene for Development* on the 29th October, 2025.

4.2 MANUSCRIPT 1: THE RESOURCES OF WATER, SANITATION AND HYGIENE INTERVENTIONS TOWARDS EFFECTIVE RESPONSE TO INFECTIOUS DISEASES: A CASE STUDY OF SCHOOLS IN UASIN GISHU, KENYA

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4.2.1. ABSTRACT

This study examined the available resources and the implementation of Water, Sanitation, and Hygiene (WASH) programs in primary schools in Uasin Gishu County, Kenya, to help prevent infectious diseases. Using both surveys and group discussions, data were collected from 51 schools. The results showed that while most school leaders are aware of WASH policies, only a few have a copy of the school health policy, which may make it harder to consistently follow the rules. Almost all schools provided safe water and kept their environments clean, but fewer focused on measures such as insect control and menstrual hygiene management. School management was the main group responsible for WASH activities, with support from external groups, teachers, and students. Most schools lacked sufficient funds to fully support WASH needs, especially public schools that depend on government funding. Most schools had mechanisms to monitor and report on WASH activities, but supervision remained a gap. The study highlights the importance of having policies in place, strong leadership, and sufficient funding to keep WASH programs functioning effectively. These findings contribute to the discussion on how school health programs can help reduce the risk of infectious and waterborne diseases in limited resource settings.

Key words: Water, Sanitation, Hygiene, WASH, school, Policy, interventions

4.2.2. INTRODUCTION

Water, Sanitation, and Hygiene (WASH) interventions are critical components of public health strategies, particularly in school settings where children are highly vulnerable to infectious diseases. Globally, the importance of WASH in schools has been recognized through various frameworks, including the United Nations General Assembly's 2010 resolution affirming the human right to water and sanitation (United Nations 2010) and Sustainable Development Goal 6, which aims to ensure availability and sustainable management of water and sanitation for all (World Health Organization 2015).

In Kenya, the Ministry of Education, together with the Ministries of Health and Water, Sanitation, and Irrigation, has developed the Kenya WASH in Schools Strategy 2024–2029. This strategy outlines the duties of various stakeholders in implementing health-related activities in schools, emphasizing coordination, monitoring, budgeting, and sustainability (Ministry of Education, Ministry of Health and Ministry of Water, Sanitation and Irrigation 2024). The National School Health Policy, first developed in 2009, provides a framework for promoting pupils' well-being through structured health programs, including WASH components (Ministry of Public Health and Sanitation and Education 2011)

Research indicates a connection between WASH infrastructure and the health of students. For example, Sharma & Adhikari (2022) discovered that 80% of Nepal's government schools had water and sanitation services, which helped lower rates of absenteeism. Similarly, Tavia Mirassou-Wolf (2017) highlighted the role of WASH programming in improving childhood wellness and educational achievement by providing equitable access to sanitation and hygiene resources.

Effective WASH implementation requires not only infrastructure but also leadership, policy enforcement, and sustainable financing. Studies in Ghana and Pakistan have shown that school-level governance, including head teacher involvement and facility management plans, is critical to maintaining WASH standards (Esseku and Roberts 2014; Ahmed *et al.,* 2021). Head teachers' commitment has been pointed as vital to the success of school health programs in Kenya (Kinuthia 2023).

This study assessed the resources for implementing WASH interventions in selected schools in Uasin Gishu County, Kenya, based on Ministry of Education protocols and new national guidelines after the COVID-19 pandemic. The study aimed to provide evidence on the resources available in schools for WASH implementation and their role in mitigating infectious disease risks in resource-constrained settings. The study findings will inform monitoring of progress towards Sustainable Development Goal 6.

4.2.3. METHODOLOGY

Study Design and Setting

This study used both quantitative and qualitative approaches to examine resources for WASH programs in primary schools. The research took place in Uasin Gishu County, in Kenya's Rift Valley region, about 330 km northwest of Nairobi. This county was chosen because it is very involved in school WASH programs as part of the national school health plan.

Study Population and Sampling

The study focused on 498 primary schools in Uasin Gishu County. Schools were selected from each of the six sub-counties (Soi, Moiben, Kesses, Turbo, Kapseret, and Ainabkoi) based on the number of schools in each area. In total, 51 schools were picked, with 24 in rural areas and 27 in towns. Of these, 41 were public schools, and 10 were private.

All head teachers or their representatives from selected schools joined the study. Additionally, 10–15 teachers from schools in three randomly chosen sub-counties participated in focus group discussions for qualitative insights.

Eligibility Criteria

Schools were eligible for inclusion if they were officially recognized by the Ministry of Education, had enrolled both male and female pupils, operated as either day or boarding institutions, and had a candidate class.

4.2.4 DATA COLLECTION INSTRUMENTS AND PROCEDURES

Numbers-based data were collected by asking head teachers questions using a set form. A checklist was also used to verify that WASH facilities were present and in good condition. These tools were digitized using CommCare, a phone app that helps collect data and check for errors.

Views and opinions were collected through group discussions using a set list of questions. These talks covered teacher training on WASH, their roles in health promotion, the quality of facilities, and whether schools followed WASH rules. All data collectors were trained in proper conduct and the confidentiality of information before data collection began. The tools were tested first to make sure they worked well.

4.2.5 DATA ANALYSIS

Quantitative data were exported from CommCare into Microsoft Excel for cleaning and subsequently analyzed using R statistical software. Descriptive statistics, including frequencies, percentages, and means were used to summarize the data. Qualitative data from FGDs were transcribed verbatim and analyzed using NVivo 15 software. Responses were categorized and compared to identify emerging themes and patterns.

4.2.6 ETHICAL CONSIDERATIONS

Ethical approval was obtained from the Institutional Research Ethics Committee (IREC) of Durban University of Technology, South Africa, and the Ethical Research Committee of the University of Eastern Africa, Baraton, Kenya. Research permissions were also secured from the Ministry of Education in Uasin Gishu County, and the National Commission for Science, Technology and Innovation (NACOSTI).

Informed consent was obtained from all participants, with assurances of confidentiality, voluntary participation, and the right to withdraw at any time. Minimal risk was posed to participants, as the study focused on institutional practices rather than individual behaviors.

4.2.7. PRESENTATION OF RESEARCH RESULTS ON THE INPUTS/RESOURCES FOR IMPLEMENTATION OF WASH IN SCHOOLS IN UASIN GISHU COUNTY

Primary schools' demographics

A total of 51 schools were sampled, including 24 rural and 27 urban schools. Of these, 10 (19.6%) were private and 41 (80%) were public.

School respondents were mainly head teachers 26 (51.0%), deputy head teachers 17 (33.3%), senior teachers 6 (11.8%). In two schools (3.9%), data was obtained from teachers heading the WASH department.

Element of WASH policy implemented in primary schools in Uasin Gishu County

Although all head teachers were aware of WASH activities, only 44 schools (86.3%) had a health policy that included WASH. 43 schools (84.3%) knew what was expected of the national and county governments regarding school WASH programs. This was true for all private schools and 80.5% of public schools. In all 51 schools, safe water was provided, and 98% had clean environments and hygiene activities. 84% had food safety activities, but only 41% did activities to control insects, pests, and rodents, maybe because these problems are not common in most schools. Only 34% of public schools and 70% of private schools did these activities as depicted in figure3.

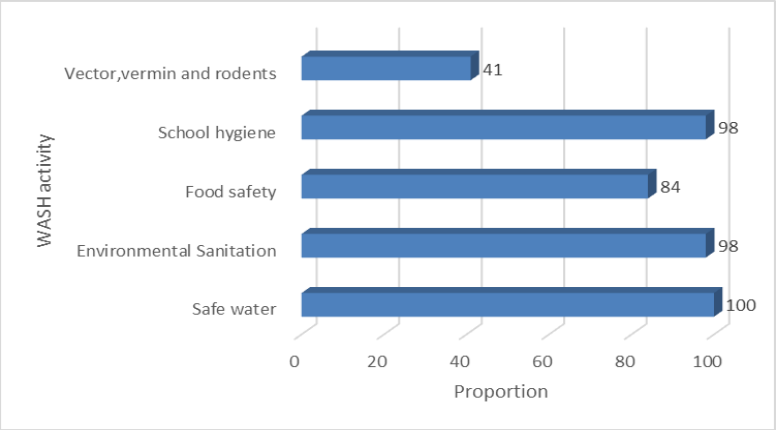


Figure 4: Implemented WASH elements in schools

Coordination of WASH activities in Primary schools in Uasin Gishu County

Nearly 88% of schools had clear WASH goals, and 80% met over half of the WASH guidelines. School management handled most water (73%), sanitation (76%), and hygiene (67%) tasks in both private and public schools, with some teachers overseeing WASH activities referring to table 8.

In my school, we have a sanitation teacher who is in charge of sanitation. Then concerning the water, fetching water, putting them in the containers, it's the work of the teacher on duty. So, if it is your week, you make sure that the water is everywhere yeah. Even the sanitation, the cleanliness, you are the one concerned. ***FGD TEA 01-R1***

And every week we have teachers on duty. So, we take care of cleanliness generally. The whole week. Yeah. FGD TEA 03-R5

The external provider helped most schools by providing water (67%) but played smaller roles in hygiene (16%) and sanitation (25%). School departments handled sanitation (29%) and hygiene (31%) activities.

In our school we have that, that that title of health and sanitation because, so it consists of three members. They coordinate. FGD TEA 02-R1

Some schools depended on students for water (14%). Students were also given jobs in hygiene (35%) and sanitation (31%), as shown in Table 11. This was also mentioned in group discussions about managing WASH activities.

Like in our school, they normally mop daily, on a daily basis. According to the duty roster, 03-R2

In our school, you have the sanitation prefect who is now concerned with the cleanliness activities. Like if it's the toilets…03-R6

Almost all schools (98%) had plans to keep WASH facilities working. 88.2% of schools had clear goals for WASH activities, with all private schools and 85% of public schools meeting this. About half (52%) of schools reported implementing 50-57% of the WASH guidelines, while a third reported implementing more than 76%. Still, 19% of public schools had done less than half of the WASH guidelines.

Table 5: Responsibility for operation and maintenance of the WASH facilities in public and private primary schools

Who	Key	All Schools	Public School	Private Schools
External provider	Water	34 (67%)	27 (66%)	7 (70%)
	Hygiene	17 (33%)	12 (29%)	5 (50%)
	Sanitation	8 (16%)	5 (12%)	3 (30%)
School management	Water	37 (73%)	28 (68%)	9 (90%)
	Hygiene	39 (76%)	29 (71%)	10 (100%)
	Sanitation	34 (67%)	25 (61%)	9 (90%)
Both External School	Water	21 (41%)	15 (37%)	6 (60%)
	Hygiene	30 (59%)	25 (61%)	5 (50%)
	Sanitation	17 (33%)	13 (32%)	4 (40%)
School departments	Water	11 (22%)	9 (22%)	2 (20%)
	Hygiene	15 (29%)	12 (29%)	3 (30%)
	Sanitation	16 (31%)	13 (32%)	3 (30%)
Pupils	Water	7 (14%)	5 (12%)	2 (20%)
	Hygiene	16 (31%)	12 (29%)	4 (40%)
	Sanitation	18 (35%)	15 (37%)	3 (30%)

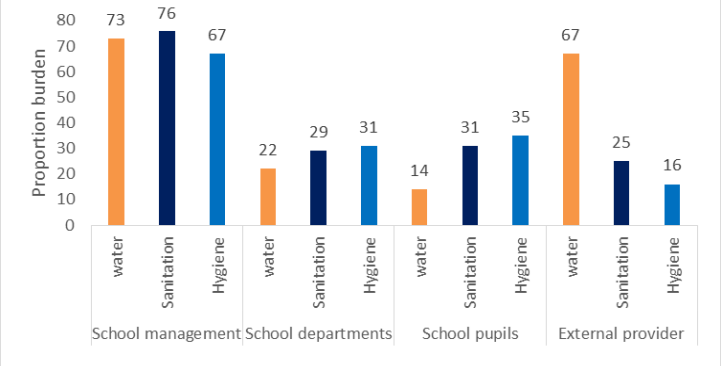


Figure 5: Responsibility for operation and maintenance of WASH facilities

Table 9 shows what head teachers and the Board of Management (B.O.M) do in WASH programs in schools. Both groups are important for running and keeping up WASH programs, but they help in

different ways. Head teachers are usually more involved in daily management, while B.O.M members focus on supervision, approving budgets, and planning.

Table 6: Role of head teacher and BOM on coordination of WASH activities

Roles	All	Public	Private
Role of the head teacher in the WASH program			
Coordinate hygiene education and promotion	47 (92%)	38 (93%)	9 (90%)
Maintenance of WASH facilities	41 (80%)	33 (80%)	8 (80%)
Ensure facility operation use and care	43 (84%)	36 (88%)	7 (70%)
Oversee construction of toilets	31 (61%)	25 (61%)	6 (60%)
Oversee fencing and solid waste management facilities	29 (57%)	22 (54%)	7 (70%)
Inspection of school sanitary facilities	30 (59%)	22 (54%)	8 (80%)
Procurement of cleaning and maintenance tools	26 (51%)	21 (51%)	5 (50%)
Role of B.O.M in the WASH program			
Approval of school WASH operation and maintenance budget	47 (92%)	39 (95%)	8 (80%)
Inspection of WASH facilities	28 (55%)	21 (51%)	7 (70%)
Monitoring and evaluation of school WASH program	36 (71%)	30 (73%)	6 (60%)

Eight schools (16%) did not know about any WASH-Day events. This was true for 17% of public schools and 10% of private schools. None of the schools celebrated Global Handwashing Day or Menstrual Health Management Day. In total, ten schools (20%) celebrated World Toilet Day. The most observed WASH-related day was World Environmental Day, celebrated by 32 schools (63%).

All schools held WASH-related meetings: 45% once a term, 22% once a month, 24% weekly, and 10% as needed. Meetings on hand washing were held by 92% of schools, on hygiene by 78%, on menstrual hygiene by 67%, and on sanitation by 55%. Private schools did slightly better than public schools. School management helped support WASH activities, as shown in table 10. Overall, 65% of schools provided

money, 88% provided materials and time for meetings, and 75% had school management check on these activities.

Table 7: Ways in which school support WASH in Uasin Gishu County

Key	All	Public	Private
Provide money	33 (65%)	27 (66%)	6 (60%)
Provide materials	45 (88%)	36 (88%)	9 (90%)
Allocating time for meeting	45 (88%)	36 (88%)	9 (90%)
Monitoring	38 (75%)	29 (71%)	9 (90%)

Budgeting and Funding of WASH in Primary schools in Uasin Gishu County

Eighteen (35.3%) schools with budgets met only 49% or less of their needs. 17 (33.3%) of those with a budget met 50-75% of the needs, while only 9 schools (17.6%) with a budget met 75% or more of the needs. Thirty-seven public schools (72.5%) received a capitation grant from the national government to cover all activities, including the school WASH program, while none of the private schools received it. Seven schools (14%) lacked allocated budgets for the operation and maintenance of WASH services. On average, the schools reported a need for Ksh. 50,000 (Fifty thousand) for the operations and maintenance of the WASH program per term. This figure varied, with some schools budgeting a minimum of Ksh. 0 (zero) while others a maximum of Ksh. 500,000 (Five hundred thousand). Private schools had a higher average budget of 97,500 Ksh (minmax, 10,000 - 360,000 Ksh) compared to public schools, 38,220 Ksh (minmax, 0 - 500,000 Ksh). In both public and private schools, school management played a major role in allocating the WASH budget, with parents also contributing, though at a reduced level. Table 11 presents the proportions of responsibility for funding school WASH (specifically water facilities) among various stakeholders.

Table11: Ways in which school support WASH in Uasin Gishu County

Key	All	Public	Private
Who is responsible for provision of the budget			

Key	All	Public	Private
School management	42 (82%)	33 (80%)	9 (90%)
County governments	10 (20%)	10 (24%)	0 (0%)
Central government	11 (22%)	11 (27%)	0 (0%)
The NGOs	7 (14%)	7 (17%)	0 (0%)
The parents	4 (8%)	3 (7%)	1 (10%)
Sources of funds water facilities			
Ministry of education	31 (61%)	31 (76%)	0 (0%)
Ministry of health	1 (2%)	1 (2%)	0 (0%)
NGO	24 (47%)	20 (49%)	4 (40%)
Not known	4 (8%)	1 (2%)	3 (30%)

During group discussions, it was said that school activities were mostly funded by the money given to each student every year. This money covers all activities, including WASH. Each student got about 200-300 shillings, which was not enough for WASH and other needs. There was a suggestion that the government allocate funds solely to water and sanitation and increase the amount.

> *I could. I am seeing they can make this water and sanitation a vote head so that they can be taken with, they can give money for this specifically and they can add the amount to go up so that it could not bring*…02-R6

Other sources of funds are from well-wishers such as NGOs, members of parliament, parents and community support.

> *And their parents also can be a source, but they pay some little amount of money. Like for example, if we need detergents for cleaning the toilets and so on; the brushes. So that money is taken from there (FGD TEA 02- R4)*

> *R3: From the, the NGO. We have also NGOs who are also sponsoring the school. Providing the water. (FGD TEA 02- R3)*

> *Also, from the Member of Parliament. Yeah, that is the tanks (FGD TEA 03-R2)*

Monitoring and Reporting of WASH in Primary schools in Uasin Gishu County.

A significant number 48 (94.1%) of the schools had a WASH monitoring system program. This included all the 100% private and 93% public schools. Overall, 45 (88%) of the schools were reporting the WASH program, 100% private and 85% public schools. Of the 51 schools, 44(88%) were monitored for WASH program less than a year ago, 4 schools had more than 2 years since their last monitoring, while 2 schools had stayed for more than 6 years without such monitoring of WASH. Ninety percent (90%) of the private schools had recently been within less than a year compared to 87.5% in public schools.

Three players came out as monitors of school WASH program. First, the Ministry of Education was reported by 29(57%) schools as the main monitor. Secondly, the school board of management at 28(55%), and non-governmental organizations 11(22%) were also key players with regards to monitoring school WASH activities.

Of the schools involved in WASH activities, 59% reported to the school board, 45% to the Ministry of Education, 43% to the Ministry of Health, and 25% to NGO or private funders. Notably there were 6(12%) that did not report to anyone as represented in table 12.

Table 8: Monitoring and reporting of WASH activities

Key	All	Public	Private
Who monitors WASH			
The school Board of Management	28 (55%)	20 (49%)	8 (80%)
Ministry of education	29 (57%)	24 (59%)	5 (50%)
Ministry of health	0 (0%)	0 (0%)	0 (0%)
NGO	11 (22%)	10 (24%)	1 (10%)
School Departments Responsible for WASH activities	0 (0%)	0 (0%)	0 (0%)
No monitoring	0 (0%)	0 (0%)	0 (0%)
Whom do you report to about WASH activities			
The school Board of Management	30 (59%)	21 (51%)	9 (90%)
Ministry of education	23 (45%)	19 (46%)	4 (40%)
Ministry of health	22 (43%)	17 (41%)	5 (50%)
NGO/Funder	13 (25%)	12 (29%)	1 (10%)
No reporting	0 (0%)	0 (0%)	0 (0%)

There was monitoring of WASH activities by the school departments or by the teachers. From the FDG interview, it was reported that the teachers monitor and oversee all activities in relation to WASH.

> *As a teacher, I always evaluate and monitor if the prefects are doing their work. Sanitation-wise and making sure that the environment is clean, the toilets are clean, the water points we have water...FDG TEA 03-R6*

> *As a class teacher. You need to make sure that the class is well maintained. Hygienically, that is the cleanliness of the class. Cleanness of the environment behind your classroom and in front of the classroom. Taking care of the water points. Maybe you have children who are on duty to fill the, the water points. Yeah. FDG TEA 03-R5*

4.2.8. DISCUSSION OF FINDINGS ON THE INPUTS/ RESOURCES FOR IMPLEMENTATION OF WASH IN SCHOOLS IN UASIN GISHU COUNTY

The resources/ input of WASH in schools

The inputs or resources for establishing the WASH program-based conceptual framework applied in the study include the school health policy, financing and budget allocation, coordination of WASH activities in schools, and monitoring and reporting of WASH activities in schools. These inputs are discussed below.

WASH policy elements implemented in schools

Though all head teachers in the 51 schools reported to have been aware of WASH activities contained in the school health policy, and while 44 head teachers reported to be in possession of a copy of school health policy, the actual confirmation on the availability of the policy revealed that only 17 schools had a physical copy of the policy, 14 of the schools being public schools and 3 being private. The absence of a school health policy may hinder the implementation of WASH activities, as ongoing activities in schools may lack clear guidance. The policy covers key areas such as Water, Sanitation, and Hygiene, with guidelines detailing implementation steps (Ministry of Public Health and Sanitation and Education, 2011). It supports the development of comprehensive school health programs (Ministry of Education and Ministry of Health, 2018). The Kenya WASH in Schools Strategy 2024-2029 sets national guidelines to address challenges like policy, monitoring, evaluation, capacity building, budgeting, financing, and sustainability.

All schools (100%) reported safe water activities, and 98% had environmental sanitation and hygiene programs. In Nepal, 80% of government schools had water and sanitation facilities (Sharma & Adhikari, 2022). The widespread availability of WASH facilities in schools is encouraging, as evidence suggests that such provisions support pupils' well-being and academic performance. For instance, research by Sharma *et al.,* (2024b) demonstrated that schools with adequate WASH infrastructure contribute positively to both student health and educational outcomes. Emerging literature further reinforces the

association between improved childhood well-being and effective school-based WASH programming. Such programs promote equitable access to essential WASH resources, including sanitation facilities, safe drinking water, hand washing stations, and soap (Mirassou-Wolf, 2017). To maintain a safe and healthy learning environment, schools must therefore implement appropriate WASH interventions aimed at preventing water- and sanitation-related infections such as diarrhea, cholera, and dysentery (Mensah *et al*., 2022).

Operation and maintenance of WASH in schools

Effective operation and maintenance of WASH facilities are vital for sustaining use and hygiene in schools. Sustained functionality of existing facilities depends largely on effective maintenance practices, which are widely recognized as a fundamental requirement for successful school WASH programs (Mensah *et al.*, 2022). This study found that school management mainly oversees WASH facility operations in both public and private primary schools. External support, mostly for safe water, benefited 67% of schools, but involvement in sanitation and hygiene was limited. Comparable patterns have been reported elsewhere; for example, a study in Pakistan found that 149 (35%) of 425 schools had received WASH-related support from non-governmental or community-based organizations within the previous five years (Ahmed *et al*., 2021).

Active involvement of school leadership, such as the board of management, head teacher, and the designated WASH teacher, is essential for the effective operation and maintenance of WASH facilities. The Kenya WASH in Schools Strategy (2024–2029) places school management or school health committees near the operational level of school health governance, with student or pupil councils positioned at the final level of implementation (Ministry of Education, Ministry of Health, and Ministry of Water, Sanitation and Irrigation, 2024). In Ghana, schools adopt a Facility Management Plan (FMP), which outlines a school's commitment to maintaining WASH infrastructure and forms a core element of the national WASH in Schools implementation model aimed at increasing WASH awareness (Esseku &

Roberts, 2014). Evidence further suggests that limited engagement of school leadership, teachers, or the surrounding community undermines the sustainability of WASH facilities (Mirassou-Wolf, 2017).

Research shows that head teachers are key to daily WASH management in schools. Previous studies have also shown that head teachers have a vital responsibility to ensure that government policies, strategies, and guidelines are implemented in schools. A cross-sectional study in Kitui-West Sub-County, Kenya, found that head teachers' commitment and leadership skills are crucial for implementing the National School Health strategic plan in primary schools. Effective implementation of government policies largely depended on the attitude of head teachers and would not succeed unless the head teacher considered them significant enough to the school (Kinuthia 2023).

WASH days that ought to be observed in schools include Global Hand washing Day, Menstrual Hygiene Day, World Environment Day, and World Toilet Day. These WASH days have been outlined in the Kenya school health guidelines for 2018 (Centre for Disease Control 2024; World Vision ND; Ministry of Education and Health 2018). It is worth noting that 16% of the schools were unaware of all the WASH days. Like findings of research conducted in schools to assess Knowledge, Attitudes and Practices on WASH in Limpopo, South Africa, it was established that none of the children in 145 schools were aware of Global Hand Washing Day and all the schools did not observe or commemorate the day (Sibiya and Gumbo 2013). It is reported that the WHO runs campaigns on or around the 5th of May each year on hand washing, aimed at bringing people together globally to support improvements in hand hygiene (Peters *et al.,* 2019). Diseases associated with poor hand washing can be prevented if schools provide adequate information and facilities for proper hygiene (Osuchukwu *et al.,* 2021). Menstrual Hygiene Day, observed annually on May 28, focuses on raising awareness about the importance of effective menstrual hygiene management (MHM) and promoting its inclusion in global, national, and local policies and programs. The day also serves as a platform for media engagement and policy dialogue with key decision-makers (Olson *et al.,* 2022). World Environment Day, marked each year on June 5, is a United Nations–led initiative that draws attention to pressing environmental challenges, encouraging collective action by governments, businesses, and the public to protect and improve environmental and planetary

health (Zarrabeitia-Bilbao *et al*., 2022). In addition, World Toilet Day seeks to increase awareness of the need for safe, dignified sanitation services and emphasizes the role of improved sanitation in reducing the transmission of disease within communities (Rudolph & Muchesa, 2023).

Budgeting and Funding of WASH in schools

Of the schools with a WASH budget, just 17.6% could meet at least 75% of their needs, while 35.3% managed less than half. Seven schools (14%) lacked an allocated budget for the operation and maintenance of WASH facilities. From the interviews conducted, it was reported that the funds allocated were inadequate, and the head teachers requested that the government provide funding specifically for WASH, not combined with funding for other activities. This lack of budget for WASH in Kenya is confirmed by a statement in the Kenya WASH in schools' strategy 2024-2029 that many counties' integrated development plans (CIDPs) do not include explicit WASH targets. This implies that if WASH is not an explicit target in the budget, it is therefore not funded and not a priority (Ministry of Education, Ministry of Health and Ministry of Water, Sanitation and Irrigation 2024). An evaluation of WASH in Tanzanian schools reported similar results. The majority (>90%) of the District Education Officers who were respondents in the study reported inadequate budgets for recurrent or maintenance expenditure (Antwi-Agyei *et al.,* 2017). Deroo et al. (2015) noted that although many nations have policies about WASH in schools, these policies often lack sufficient funding and are inconsistently implemented. Investments in sanitation infrastructure often prioritize construction while giving limited attention to the ongoing financial requirements for operation, maintenance, and service continuity. Although national commitments to WASH are widespread, implementation remains uneven. Ahmed *et al.,* (2021) reports that while 89% of countries worldwide have national WASH policies, only 15% have formally endorsed water and sanitation policies that are supported by adequate implementation plans, staffing, and financial resources. Evidence from schools in Bishoftu Town, Ethiopia, indicates that the allocation of dedicated school-level funding for WASH is a critical determinant of service availability, with schools lacking such budget lines exhibiting poorer WASH conditions (Girmay *et al*., 2023). Similarly, a multi-country review

of rural schools across 14 low- and middle-income countries emphasized the importance of earmarked budgets for WASH programs and essential supplies to ensure sustainable service delivery (Cronk *et al.,* 2021). Insufficient financial investment has been consistently linked to inadequate WASH infrastructure, particularly in rural settings (Tseole *et al.,* 2022). Notably, schools with a designated WASH budget line were found to be 8.5 times more likely to provide basic hygiene services compared to schools without targeted funding (Girmay *et al*., 2023).

Monitoring of WASH facilities in schools

Monitoring WASH facilities in schools is considered important for improving students' health and well-being, as well as education. School WASH monitoring promotes safe water, proper sanitation, and hygiene, helping prevent disease and supporting a healthy learning environment for students (World Health Organization 2023).

The WHO–UNICEF Joint Monitoring Program has expanded its database to include WASH in schools, using indicators aligned with the SDGs at national, regional, and global levels (UNICEF & WHO, 2022b). In Kenya and Honduras, Ministries of Education play a central role in coordinating WASH in schools, supported by health sectors, NGOs, and development partners, with Kenya emphasizing harmonized monitoring systems integrated into national education databases (Ministry of Education et al., 2024; Save the Children, 2017). Findings from this study and evidence from India and Burkina Faso show that monitoring responsibilities vary across contexts and involve education authorities, health professionals, government representatives, NGOs, and community committees (Dakhode *et al*., 2022; Kere *et al*., 2016). However, inadequate surveillance capacity, particularly limited human resources at the local level, remains a major constraint to effective school WASH monitoring, as also reported in Ethiopia and Tanzania (Girmay *et al*., 2023; Antwi-Agyei *et al*., 2017).

4.2.9. CONCLUSION

This study examined the resources used in implementing WASH interventions in primary schools across Uasin Gishu County, Kenya, highlighting their role in infectious disease prevention and health promotion. The findings reveal that while awareness of WASH policies is widespread among school leadership, the actual possession and application of formal policy documents remain limited. Most schools have implemented core WASH activities, such as safe water provision and environmental sanitation, yet critical components, such as vector control and menstrual hygiene management, are inconsistently addressed.

School management was the main group responsible for running and maintaining WASH facilities, with support from external groups, teachers, and students. Lack of funding, especially in public schools, made it hard to fully implement WASH guidelines, and many schools could not meet even half their needs. Most schools had ways to check and report on WASH activities, but there were still gaps in supervision and collaboration across groups.

Overall, the study underscores the importance of structured policy dissemination, adequate financing, and coordinated leadership in sustaining effective WASH programs. These elements are key to better school health and stronger disease outbreak resilience.

4.2.10 RECOMMENDATIONS

1. Strengthen policy dissemination and enforcement

The Ministry of Education should provide all schools with physical copies of the national school health policy and WASH guidelines. Conducting regular training and information sessions for school administrators will support effective implementation of these policies. Additionally, establishing a dedicated vote head for WASH activities within school budgets will promote consistent funding and minimize dependence on general capitation grants, which frequently prove inadequate.

2. Establish dedicated budget lines for WASH

Government stakeholders should consider creating a specific vote head for WASH activities within school budgets. This would ensure consistent funding and reduce reliance on general capitation grants, which are often insufficient.

3. Enhance multi-stakeholder collaboration

Greater coordination among the Ministry of Education, the Ministry of Health, the Ministry of Water, and non-governmental organizations is needed to streamline support, monitoring, and technical assistance for school WASH programs.

4. Promote inclusive WASH practices

Schools should be encouraged to include menstrual hygiene and toilets that are easy for students with disabilities to use in their WASH programs, so everyone is treated fairly.

5. Institutionalize monitoring and evaluation frameworks

All schools should implement a unified system for monitoring and reporting, which includes routine audits and feedback channels to assess progress and pinpoint areas that need enhancement.

6. Empower school communities

Teachers, students, and Boards of Management should take an active role in planning and overseeing WASH activities. Training and reward programs can help everyone feel responsible and involved.

Limitations of the study

This study has some limitations. Although the 51 schools chosen provide a good picture, the sample is still small, so the results may not apply to other counties in Kenya or to other countries. Because the study only looked at one point in time, we cannot see changes over time or know for sure what causes what. Also, some information came from teachers' own reports, which might not always be accurate.

4.2.11. DECLARATIONS

Consent for publication

The research paper does not contain any individual, personal data in any form. No consent for publication needed. Consent for publication is not applicable.

Availability of data and materials

All data from this study are available in the article or in the supplementary information files. The information generated during this study will also be available DUT library repository.

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Competing interests

The authors declare that they have no competing interests.

Authors' contributions

GCS conceptualized the study and drafted the proposal under the supervision of GGM and MAGN. GCS and GGM worked on developing the background and designing the study. GCS prepared the manuscript, which was critically reviewed by GGM and MAGN. GCS also accessed library resources and conducted data analysis. All authors (GCS, GGM, and MAGN) contributed to revising the draft and approved the final version of the manuscript

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4.2.12. REFERENCES LIST

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Manuscript 2 presented the research findings and discussion on document analysis of school health and education policies as part of supplementary information for research objective number 2. The information gathered provided the landscape, track changes and development over time of Kenya School Health Policies documents, guidelines and other related documents which contained components of WASH. Manuscript 2 has not been submitted to any journal.

4.3 MANUSCRIPT 2: STRENGTHENING WATER, SANITATION, AND HYGIENE (WASH) IN KENYAN SCHOOLS: A DOCUMENT ANALYSIS OF SCHOOL HEALTH AND EDUCATION POLICIES.

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4.3.1. ABSTRACT

Background: Water, sanitation and hygiene (WASH) in schools is increasingly recognized as critical to learner health, equity, and educational outcomes. Kenya has produced multiple policy, legislative, and strategic instruments addressing school WASH over the past two decades, yet a consolidated analysis of how this policy landscape has evolved over time remains limited.

Methods: A deductive–inductive thematic document analysis was conducted on twelve key documents published between 2008 and 2024, including the National School Health Policy, Kenya WASH in Schools Strategy (2024–2029), Menstrual Hygiene Management Policy, and the Basic Education Act. The study was conducted as part of a broader case study and aimed at providing supplementary data concerning the policy documents and guidelines related to the WASH in primary schools in Kenya.

Results: Eight overarching themes emerged, showing a clear evolution from broad safety and welfare orientations toward quantified standards, rights-based approaches, and system integrated accountability, particularly in relation to sanitation ratios, water quality surveillance, MHM, governance under devolution, and integrated monitoring systems. The analysis revealed a comprehensive and multi-sectoral policy environment aligned with global standards such as the Sustainable Development Goals (SDGs). However, gaps persist in implementation consistency, funding sustainability, enforcement mechanisms, and community engagement.

The study recommends increased investment in WASH infrastructure, enhanced capacity building, improved monitoring and evaluation systems, and stronger stakeholder coordination. Addressing these gaps is critical to ensuring equitable access to safe and healthy learning environments for all learners in Kenya.

4.3.1 INTRODUCTION

Providing adequate Water Sanitation and Hygiene (WASH) services within educational institutions is pivotal for the holistic development of children (Ngure *et al.* 2014). A healthy, hygienic learning environment is key to strong cognitive function and academic success. In Kenya, the government has made significant strides in integrating WASH into the school curriculum, hoping to improve students' health and well-being (Waddington *et al.* 2009). The WASH programs are anchored in a series of policy documents and guidelines, primarily the Kenya National School Health Policy, 2009; National school health guidelines, 2009; Safety Standards Manual for Schools in Kenya, 2008; National School Health Strategy Implementation Plan 2011/2015; Kenya school health policy, 2018; Kenya School Health Implementation Guideline, 2018; Guidelines on Health and Safety Protocols for Reopening of Basic Education Institutions Amid Covid-19 Pandemic; The basic education act 2013; Basic Education Bill, 2024; Kenya WASH in schools Strategy 2024 – 2029; Kenya Menstrual Hygiene Management policy 2019-2024; and the Kenya Menstrual Hygiene Management (MHM) Strategy 2024-2029

The documents collectively establish a national framework to enhance schoolchildren's health and educational outcomes by promoting adequate WASH facilities and practices. Policy documents list WASH as a core part of school health programs, along with values and life skills, gender issues, growth and development, child rights, nutrition, disease prevention, special needs, infrastructure, environmental safety, and gender mainstreaming.

By analyzing key policy documents such as the KSHP 2009 and 2018, the KSHIG 2018, the Basic Education Act 2013, and the Basic Education Bill 2024, this research seeks to interrogate the framework of policy implementation and to understand how WASH programs have been implemented and their impact on the target population. These policy frameworks outline the government's commitment to providing a safe and healthy school environment, emphasizing the importance of WASH in achieving this goal. This study reviewed literature and policy on WASH in schools to identify best practices, challenges, and areas for improvement.

Document analysis within the field of health policy entails the systematic evaluation of policy documents to discern objectives, strategic approaches, and the broader implications for the healthcare system. It involves reviewing written, printed, or digital materials to identify patterns, key insights, and relevant data for research (Morgan 2022). Document analysis is important because it helps researchers extract meaningful information from existing documents and texts. It provides context, helping researchers understand the background, trends, and key themes related to their study. It supports or challenges findings to validate or refine conclusions. It ensures the credibility of research findings and allows for triangulation. It provides a historical record allowing researchers to track changes over time. It identifies patterns and themes for ideas and trends. It is efficient in saving time and resources (Bowen 2009). This analysis reviews Kenya's WASH-related school policies and laws to evaluate their scope, implementation, and alignment with education and public health goals.

4.3.3. METHODOLOGY

Research design

This study employed a qualitative document analysis design to systematically examine Kenya's national policies, guidelines, strategies, and legislative frameworks related to WASH in schools. The approach was chosen for its effectiveness in extracting meaning, identifying patterns, and interpreting policy content within a specific socio-political and educational context (Dalglish, Khalid, and McMahon 2021). In the realm of health policy, document analysis is a powerful tool for uncovering the underlying principles, goals, and strategies guiding public health interventions (Brownson, Chriqui, and Stamatakis 2009). By analyzing policy documents, researchers can gain valuable insights into the policy landscape and inform evidence-based improvement strategies. To comprehensively examine policy documents and guidelines of school health that contain WASH components in schools, several document analysis methodologies were employed. According to Armstrong (2021), these multiple methodologies enable a systematic and rigorous exploration of available policy documents.

Document selection and inclusion criteria

The analysis included national-level policies, guidelines, legislative instruments, and strategies relevant to school WASH and school health published between 2008 and 2024. Documents addressed domains of water supply, sanitation, hygiene, food safety, menstrual health management, governance, financing, capacity building, and monitoring and evaluation.

Sources included official government websites, academic databases, and stakeholder interviews. Both hard copies and digital versions were reviewed, ensuring comprehensive coverage of the policy landscape.

Document analytical approach

A thematic analysis approach was applied to the spreadsheet fields (e.g., policy background, goals/aims, water, sanitation, hygiene, food safety, menstrual health management, institutional frameworks, advocacy/resource mobilization, capacity building, and monitoring and evaluation). Recurrent concepts were coded and grouped into overarching themes and subthemes. The analysis then examined how the emphasis and specificity of these themes evolved across the period 2008–2024, drawing only on the textual content present in the dataset.

The dataset was taken through the following steps:

1. **Data familiarization**: Read each document entry across the spreadsheet fields (policy background, goals/aims, WASH domains, governance, financing, capacity building, M&E).

2. **Initial coding**: Noted repeated concepts (e.g., “safe drinking water,” “hand washing near toilets,” “gender-separate toilets,” “M&E indicators,” “committees”).

3. **Theme development**: Grouped codes into higher-level themes (e.g., “WASH as education enabler,” “standards & ratios,” “governance”).

4. **Trend review**: Compared earlier documents (2008–2013) with later ones (2018–2024) to identify shifting priorities and increasing specificity.

4.3.4. ETHICAL CONSIDERATIONS

As the study relied exclusively on publicly available documents, it did not involve human subjects and therefore did not require formal ethical approval. Nonetheless, ethical rigor was maintained by accurately representing the content of each document, citing all sources appropriately, and respecting intellectual property and institutional authorship.

4.3.5. DOCUMENT ANALYSIS FINDINGS

4.3.5.1 Introduction and scope of the document analysis

This document analysis synthesizes patterns and trends across the government documents captured in your dataset (2008–2024), with a particular focus on how school WASH is framed, operationalized, governed, financed, and monitored over time. The reviewed documents include policies, guidelines, legislative instruments (Act/Bill), and strategies/implementation plans. Collectively, they position WASH in schools as central to safeguarding learner health, promoting participation and retention, and supporting inclusive and equitable education outcomes.

Documents reviewed

All government documents, including policies and guidelines that contained information on WASH in schools, were included. All documents, regardless of year of publication, were included to assess trends in policy reviews. Table 9 lists all the policies and guidelines included in the analysis. The researcher systematically reviewed twelve key documents published between 2008 and 2024, including the National School Health Policy, Kenya WASH in Schools Strategy (2024–2029), Menstrual Hygiene Management Policy, and the Basic Education Act. The study was conducted as part of a broader case study and aimed at providing supplementary data concerning the policy documents and guidelines related to the WASH in primary schools in Kenya.

Table 9: The documents included in document analysis

Serial number	Document	Type of document
1.	National School Health Policy,2009	Policy
2.	National school health guidelines, 2009	Guideline
3.	Safety Standards Manual for Schools in Kenya, 2008	Guideline
4.	National School Health Strategy Implementation Plan 2011/2015	Implementation plan
5.	Kenya school health policy, 2018	Policy
6.	Kenya School Health Implementation Guideline, 2018	Guideline

7.	Guidelines on Health and Safety Protocols for Reopening of Basic Education Institutions Amid Covid-19 Pandemic	Guideline
8.	The basic education act 2013	Legislative Act
9.	Basic Education Bill, 2024.	Legislative Bill
10.	Kenya Water Sanitation and Hygiene (WASH) in schools Strategy 2024 – 2029	Strategy
11.	Kenya Menstrual Hygiene Management policy 2019-2024	Policy
12.	Kenya Menstrual Hygiene Management (MHM) Strategy 2024-2029	Implementation strategy

In comparison, the introductory pages of the policies and guidelines that included WASH in schools most often included a foreword, but many lacked a preface. Two documents lacked an acknowledgment and a policy background page, as shown in Table 10.

Table 10: Comparison of Introductory pages of the documents for analysis

Documents	**Foreword**	**Preface**	**Acknowledgment**	**Policy background**
National School Health Policy,2009	✓	✓	✓	×
National school health guidelines, 2009	✓	✓	✓	×
Safety Standards Manual for Schools in Kenya, 2008	✓	✓	✓	✓
National School Health Strategy Implementation Plan 2011/2015	✓	×	✓	✓
Kenya school health policy, 2018	✓	×	✓	✓
Kenya School Health Implementation Guideline, 2018	×	×	×	✓
Guidelines on Health and Safety Protocols for Reopening of Basic Education Institutions Amid Covid-19 Pandemic	✓	×	×	✓
The basic education act 2013	✓	×	✓	✓
Basic Education Bill,2024.	×	✓	✓	✓
Kenya Water Sanitation and Hygiene (WASH) in schools Strategy 2024 – 2029	✓	✓	✓	✓

Kenya Menstrual Hygiene Management Policy 2019 – 2030	✓	✓	✓	✓

Thematic findings

Eight overarching themes emerged, showing a clear evolution from broad safety and welfare orientations toward quantified standards, rights-based approaches, and system-integrated accountability, particularly in relation to sanitation ratios, water quality surveillance, MHM, governance under devolution, and integrated monitoring systems

Theme 1: WASH as a foundation for education outcomes and child wellbeing

Subtheme 1.1 Health–education linkage (access, retention, equity, completion)

Across the document set, WASH is repeatedly framed as essential to educational success rather than a purely infrastructural concern. The 2009 National School Health Policy explicitly links health to the success of educational programs and to "equal access, retention, inclusion, equity and completion," positioning learner health as a prerequisite for quality learning outcomes. The 2009 National School Health Guidelines similarly embed WASH within national commitments to Education for All and the Millennium Development Goals, emphasizing improved health of children for better participation and performance in education. In later documents, this argument is deepened through more explicit articulation of how WASH deficits undermine learning: the 2024 WASH in Schools strategy notes that poor WASH conditions often compounded by other stressors—undermine children's ability to be healthy and learn.

Subtheme 1.2 Protection and dignity within school environments

The framing expands over time to include protection and dignity concerns, especially for adolescent girls. The 2024 WASH in Schools strategy identifies inadequate sanitation as increasing risks (including for girls) and reducing learning opportunities “especially when they are menstruating,” thereby connecting WASH deficits to safety, dignity, and attendance.

Theme 2: Water provision shifts from general availability to treatment, surveillance, and quantified standards

Subtheme 2.1 Availability of safe water for drinking and hygiene

A recurring requirement across policy and guideline instruments is the provision of safe water in schools. The 2009 National School Health Policy specifies that “adequate, safe drinking water points/fountains shall be available in each school.” The 2018 Kenya School Health Policy reinforces this expectation through school governance structures, stating that the Board of Management should ensure availability of adequate safe drinking water points that are well maintained.

Subtheme 2.2 Water treatment and quality control mechanisms

Guidelines provide progressively operational detail on how water safety should be assured. The 2009 National School Health Guidelines identify filtration, boiling, and chlorination as appropriate treatment methods and assign overarching responsibility for water/sewerage provision to the Ministry of Water and Irrigation while emphasizing school-level responsibility for availability and treatment. The 2018 Kenya School Health Implementation Guideline further strengthens this by calling for water quality surveillance and monitoring “every term,” along with appropriate storage and sensitization on operation and maintenance.

Subtheme 2.3 Quantification of minimum service levels

By 2024, the discourse advances toward measurable standards. The WASH in Schools strategy specifies “2.5 liters of treated water per child per day,” signaling a shift from broad guidance to quantifiable benchmarks for service adequacy.

Theme 3: Sanitation evolves toward gender separation, ratios, maintenance systems, and comprehensive waste management

Subtheme 3.1 Privacy and gender-responsive sanitation

Gender separation and privacy are consistent requirements. The 2009 National School Health Guidelines require adequate sanitation facilities with separate provisions for boys and girls, emphasizing privacy, maintainability, and cleanliness. The 2018 Kenya School Health Policy strengthens this by requiring sanitation facilities designed to be gender sensitive and suitable for different age groups and learners with special needs, referencing relevant legal and safety standards.

Subtheme 3.2 Ratio-based planning and functional usability

Later guidelines become more specific about sanitation ratios and design. The 2018 Implementation Guideline specifies recommended ratios of “1 door for 25 girls” and “1 door for 30 boys,” alongside provisions for learners with special needs and disabilities. The 2024 WASH in Schools strategy reiterates ratio guidance and adds operational usability requirements such as “no open defecation,” clear signage, duty rosters for cleaning, and facility condition expectations.

Subtheme 3.3 Waste management as a sanitation priority

Sanitation is consistently connected to waste management beyond toilets. The 2018 Kenya School Health Policy requires acceptable management of solid and liquid waste within schools. The 2024 WASH in Schools strategy further details waste systems including compost pits/garbage management, refuse pits, classroom bins, and wastewater recycling for irrigation/tree planting, indicating expanded attention to environmental sanitation and sustainability.

Theme 4: Hygiene promotion is institutionalized as continuous behavior change supported by infrastructure

Subtheme 4.1 Hand washing with soap and strategic placement near toilets (and school activity areas)

Hand washing infrastructure recurs as a minimum requirement. The 2009 National School Health Policy calls for hand washing facilities with soap "located within the vicinity of the toilet/latrine." The 2018 Kenya School Health Policy extends this by requiring hand washing facilities near toilets/latrines as well as eating and play areas. The 2018 Implementation Guideline specifies "one hand washing point per 25 learners" and emphasizes that placement should consider age, special needs, and disability.

Subtheme 4.2 Hygiene promotion as ongoing, learner-centered, and school-to-community spillover

Behavior change is consistently framed as continuous rather than episodic. The 2009 National School Health Policy states that hygiene promotion will be "pupil centered and an ongoing process," with "spillover effect" from schools to homes to influence behavior change. The 2018 Kenya School Health Policy similarly emphasizes hygiene promotion as learner centered and ongoing, aimed at positively influencing behavior change. The 2024 WASH in Schools strategy reinforces institutionalization through reminders (posters/talking walls), school health clubs, and cleaning frequency logbooks.

Theme 5: Food safety is treated as a school health safeguard with strong compliance expectations

Subtheme 5.1 Inspection, storage, preparation hygiene, and handler requirements

Food safety appears prominently in guidelines and legislative instruments. The 2009 Guidelines specify inspection by the Environmental Health department, appropriate food storage standards, hygienic preparation practices, and medical examination of cooks. The 2018 Implementation Guideline further elaborates requirements for storage facilities (perishable and dry foods), food preparation surfaces that are easy to clean and non-toxic, separation of raw meat from cooked food, and medical examination and protective gear for cooks, including compliance during school events under the Food, Drugs and

Chemical Substances Act (Cap 254). The Basic Education Act (2013) also mandates high standards in food preparation and storage and hygiene in feeding programs to prevent contamination.

Theme 6: Menstrual health management (MHM) expands from product provision to a comprehensive rights-based and systems approach

Subtheme 6.1 MHM as a barrier to attendance and participation

The 2011/15 Strategy Implementation Plan introduces a strongly problem-focused framing, referencing large numbers of menstruating girls and missed school days due to lack of pads/underwear and inadequate sanitary facilities, thus positioning MHM as a key participation barrier. The 2024 WASH in Schools strategy reiterates that inadequate sanitation particularly undermines learning opportunities during menstruation, and also elevates protection concerns.

Subtheme 6.2 Facilities, privacy, and disposal systems

Earlier documents include pad provision and disposal. The 2009 National School Health Policy states that ministries should facilitate provision of affordable sanitary pads and safe disposal, and provide counselling/support services. By 2018, implementation guidance becomes more detailed, calling for bathrooms/changing rooms, sanitary bins, disposal facilities, and systems for transporting used towels to appropriate treatment technologies. The 2019 MHM Policy consolidates this into a rights-based mission emphasizing dignity, access to information, products, services and facilities, and safe menstrual waste disposal.

Subtheme 6.3 Stigma reduction and rights-based governance

The 2019 MHM Policy explicitly identifies stigma, myths, and taboos as drivers of poor menstrual experiences and sets a rights-based objective to ensure menstruation is managed “freely, with dignity without stigma or taboos.” The 2024 MHM Strategy reinforces a structured MHM framework

(hardware, hygiene promotion, products, enabling environment) and underscores the importance of monitoring and evaluation in results-based programming.

Theme 7: Governance and institutional coordination remain multi-level and become increasingly aligned with devolution

Subtheme 7.1 multi-tier committees from national to school level

A recurring pattern is the presence of structured coordinating committees. The 2009 school health instruments outline national, provincial, district, divisional, zonal/locational, and school-level committees. In 2018, governance structures are updated to include national secretariats and county/sub-county/ward/school committees consistent with devolved governance. The 2024 WASH in Schools strategy continues these structures and includes student/pupil councils, indicating expansion of participatory governance.

Subtheme 7.2 Defined responsibilities for Boards of Management and school leadership

The 2018 Kenya School Health Policy assigns key WASH responsibilities to Boards of Management, including maintaining water points and ensuring handwashing facilities with soap near key school spaces. Legislative instruments similarly define governance roles via Boards of Management, School Management Committees, and head teachers/principals for operational delivery and compliance.

Theme 8: Accountability strengthens through financing safeguards, capacity building, and integrated M&E systems

Subtheme 8.1 Resource mobilization and financing discipline

Resource mobilization is consistently mentioned, but later documents add stronger safeguards and financing mechanisms. The 2018 Implementation Guideline warns against diversion of capitation grant

funds meant for WASH without approval and calls for local and international resource mobilization. The 2024 WASH in Schools strategy goes further by emphasizing full lifecycle cost budgeting, expanding financial mechanisms, harmonizing tools, training on budgeting, and commissioning studies to strengthen sustainability.

Subtheme 8.2 Capacity building as systematic, multi-level training

Capacity building is repeatedly described as need-based and targeted, delivered across national to school levels. The 2009 policy instruments specify pre-service, in-service and on-the-job training at multiple levels. The 2018 guideline reiterates multi-level training responsibilities, while the 2020 COVID-19 reopening guideline includes structured capacity building (communities of practice, response committees, training for heads and teachers).

Subtheme 8.3 Monitoring and evaluation evolves into integrated indicator systems

M&E language appears consistently across the dataset, beginning with statements that an M&E system "shall be developed" with tools and indicators. Over time, M&E becomes more operational and system-linked. The 2020 COVID-19 guideline lists explicit measurable indicators (numbers of water sources, toilets, special needs toilets, IEC materials, trained staff), reflecting a performance-monitoring orientation. By 2024, the WASH in Schools strategy proposes harmonized indicators integrated into NEMIS and aligned to JMP/SDGs, a national dashboard, and participatory self-assessment with recognition mechanisms.

Policy evolution synthesis (2008 → 2024)

Across the period, the policy trajectory shows a clear movement from broad safety-and-welfare expectations to quantified standards and system-integrated accountability. The 2008 Safety Standards Manual frames WASH through the lens of school safety, emphasizing clean water, sanitation hygiene, handwashing after toilet use, and food hygiene alongside monitoring through checklists and routine visits. In 2009, school health policy and guidelines formalize WASH as an education-enabling

intervention tied to learning outcomes and national development commitments, introducing core expectations such as safe water points, hand washing with soap near toilets, gender-separated sanitation, and ongoing hygiene promotion supported by multi-level coordinating structures.

The 2011/15 Strategy Implementation Plan shifts toward measurable implementation targets (e.g., increasing school access to safe water and sanitation coverage) and highlights MHM-related absenteeism as a major barrier to girls' education, elevating menstruation from a welfare concern into a strategic issue. In 2013, the Basic Education Act embeds WASH requirements in law, requiring clean and functional water and sanitation, hand washing amenities, hygiene education, food safety standards, and menstrual-friendly provisions, alongside structured governance and inspection/accountability systems.

By 2018, Kenya's school health policy instruments align with inclusivity and devolution, adding specificity such as sanitation and hand-washing ratios, termly water quality surveillance, disability-responsive design, detailed food safety requirements, and stronger resource mobilization and M&E commitments. The 2019 MHM Policy consolidates a rights-based approach focused on dignity, stigma reduction, access to information/products/facilities, safe waste management, governance mechanisms (task force), and accountability. The 2020 COVID-19 reopening guidelines then act as a practical accelerator, emphasizing hand hygiene infrastructure across learning spaces, disinfection, food handler compliance, and measurable monitoring indicators. Finally, 2024 instruments (Basic Education Bill, WinS strategy, and MHM strategy) consolidate reforms and specify quantifiable service standards (e.g., liters per child/day), governance participation (including pupil councils), financing mechanisms, and integrated national monitoring systems (NEMIS-aligned indicators and dashboards), reflecting a mature accountability orientation.

4.3.6. DISCUSSION

The successful implementation of WASH programs in Kenyan public primary schools hinges on a robust foundation of resources and inputs. These resources encompass both the physical infrastructure needed

to create a clean environment and the human capital to drive program execution. The analysis of WASH (Water, Sanitation, and Hygiene) interventions in Kenyan public primary schools reveals a promising foundation built on clear policy commitments and a range of implemented activities. However, persistent challenges must be addressed to enhance the effectiveness of these programs (Abuya *et al.* 2015).

An important observation is the pronounced focus on providing sufficient infrastructure, including safe drinking water points and distinct sanitation facilities for male and female students. The 2009 KSHP, Basic Education Act 2013, and 2018 KSHIG all underscore the importance of these amenities to maintain a clean, secure, and supportive learning environment. The Basic Education Act, 2013, mandates the government to provide adequate infrastructure in schools, including sanitation facilities. This aligns with findings from the 2009 KSHP and the 2018 KSHIG, which emphasize the necessity for safe drinking water points and separate sanitation facilities for boys and girls.

Despite these policy requirements, many schools, especially in rural areas, struggle with insufficient infrastructure due to financial constraints and logistical issues (Adedeji and Olaniyan 2011). Consequently, this leads to inadequate or poorly maintained facilities, which can undermine the intended benefits of the WASH programs.

The effective implementation of WASH programs relies heavily on advocacy and resource mobilization. Establishing the National School Health Inter-Agency Committee is a significant step in mobilizing resources and advocating for health initiatives in schools. Additionally, the involvement of the local community is crucial, as it plays a vital role in supporting grassroots resource mobilization. Advocacy and resource mobilization play critical roles in supporting WASH programs (Nabalema 2015). For instance, the Basic Education Act, 2013, outlines the allocation of financial resources to schools, which should support infrastructure improvements, including WASH facilities. Additionally, the Basic Education Bill 2024 emphasizes the need for improved resource mobilization strategies to address specific needs. However, the effectiveness of advocacy efforts varies across different regions (Khagram,

Riker, and Sikkink 2002). Additionally, while some schools benefit from robust support and funding, others struggle with inconsistent resource allocation (Mascitti-Miller 2012). Effective advocacy must be complemented by targeted resource mobilization strategies that address the specific needs of different schools, ensuring equitable access to WASH resources across all regions. Capacity building has emerged as a significant component of WASH in current documents, with emphasis on training school staff and stakeholders. Training is need-based and targeted, ensuring that school staff and stakeholders are well-equipped to implement these programs effectively. Collaborations with various organizations provide additional training and resource support, enhancing schools' capacity to deliver WASH interventions. The KSHIG 2018 and the Basic Education Bill 2024, for instance, focus on needs-based and targeted training as an effective way to empower school communities to manage WASH interventions effectively. Targeted training has improved WASH practices in many schools, supporting program sustainability (Jordanova *et al.* 2015), though a study in India noted issues with the consistency and quality of training (Das *et al.* 2012).

Hygiene education has been a core component of WASH programs, with a focus on integrating it into the school curriculum and using interactive methods to engage students (Holt and Hoppes 2017). The 2009 KSHP and the 2018 KSHP highlight the importance of pupil-centered hygiene promotion techniques consistent with other documents (Manthey 1962). The effectiveness of these activities, however, depends on their integration into the curriculum and on student engagement (Leclert, Affolter, and Ndenga 2018). Interactive methods, such as games and role-playing, have shown promise for making hygiene education more effective (Wheeler 2006).

Ensuring the availability of clean and safe drinking water is a fundamental activity of WASH programs (Antwi-Agyei *et al.* 2017). The 2009 KSHP's emphasis on water source development, treatment, and storage is vital for maintaining water quality and ensuring accessibility.

However, implementing these activities can be challenging due to inadequate infrastructure, irregular maintenance, and varying levels of access to clean water sources. For example, rural schools may face difficulties in accessing safe water due to the lack of infrastructure and financial resources for water treatment (Murei *et al.* 2022). Addressing these challenges requires a coordinated approach that includes

improving infrastructure, establishing reliable maintenance systems, and exploring innovative solutions to water access.

The construction and ongoing maintenance of sanitation facilities are critical components for promoting hygiene and mitigating disease transmission, as underscored by the 2018 KSHIG. Persistent challenges such as insufficient facilities, suboptimal maintenance practices, and restricted access to clean water for hand washing can significantly reduce the efficacy of sanitation interventions (Kamara *et al.* 2017). Several programs highlight the necessity for routine facility maintenance and uninterrupted student access to clean water as vital factors in the successful implementation of WASH initiatives (Murei *et al.* 2022).

Menstrual hygiene management (MHM) has been a central focus within WASH programming, with policy measures directed at ensuring the provision of menstrual hygiene products and suitable facilities for female students (Mahon and Fernandes 2010). The 2018 KSHP and KSHIG both emphasize the pivotal role of MHM in empowering girls to manage their menstrual health with dignity. Evidence suggests that the introduction of MHM activities has positively influenced girls' school attendance and engagement (Sommer *et al.* 2021a). Nevertheless, significant obstacles remain, including inadequate facilities, limited availability of menstrual products, and persistent cultural taboos (Kaur, Kaur, and Kaur 2018). Sustained efforts are therefore required to guarantee consistent access to MHM resources and to address the varying needs of girls across diverse regions.

Effective monitoring and evaluation (M&E) are critical for assessing the impact of WASH programs worldwide (Njama 2015). The 2009 KSHP and 2018 KSHIG emphasize the importance of structured M&E systems to track the effectiveness of interventions.

WASH interventions have consistently demonstrated beneficial effects on student health by decreasing the prevalence of waterborne diseases and supporting improved well-being through access to clean drinking water, adequate sanitation facilities, and comprehensive hygiene education (McMichael 2019). However, disparities in the effectiveness of these interventions across schools and regions may influence the extent of health improvements achieved in certain areas (Fewtrell *et al.* 2005).

School health and education Policy Strengths

Comprehensive policy framework: Kenya has made commendable progress in establishing a comprehensive policy environment that supports WASH in schools. One of the most notable strengths is the existence of a wide range of interlinked documents, including policies, guidelines, strategies, and legislative acts, developed between 2008 and 2024. These documents collectively form a robust framework that reflects the government's sustained commitment to improving school health and hygiene.

Alignment with global standards: One key strength lies in the alignment of these policies with global standards such as the Sustainable Development Goals (SDGs), Education for All (EFA), and the Millennium Development Goals (MDGs). This alignment ensures that Kenya's efforts are not only nationally relevant but also globally responsive, hence, reinforcing the country's dedication to universal health and education rights.

Multi-sectoral Collaboration: The policies also demonstrate strong multi-sectoral collaboration. Ministries such as Education, Health, Water, Agriculture, and Social Protection are actively involved, alongside development partners like UNICEF, UNESCO, USAID, World Vision, and Plan International. This inter-agency cooperation enhances the reach and effectiveness of WASH programs, thus guaranteeing diverse expertise and resource mobilization.

Gender-Sensitive and Inclusive Design: Several documents articulate gender sensitivity and inclusivity very well. Policies mandate the provision of separate sanitation facilities for boys and girls and emphasize the need for accessible infrastructure for learners with disabilities. Menstrual Hygiene Management (MHM) is also addressed through dedicated policies and strategies, which aim to reduce stigma and ensure dignity for girls in school environments.

Institutional Structures and Governance: Institutional structures are clearly defined, with governance mechanisms extending from national committees to school-level health clubs and community

engagement platforms. These structures facilitate coordinated implementation and monitoring of WASH interventions.

Monitoring and Evaluation Systems: Strength is the integrated monitoring and evaluation systems, which are embedded in national platforms such as the National Education Management Information System (NEMIS). The specified indicators for infrastructure, hygiene practices, and menstrual health enable data-driven decision-making and accountability.

Capacity Building and Training: Capacity building is emphasized through training programs for teachers, health workers, and other stakeholders. The inclusion of trauma support and blended learning strategies during the COVID-19 pandemic reflects the policy environment's adaptability and responsiveness.

Resource Mobilization and Budgeting: Finally, resource mobilization is addressed through budgeting tools and costed strategies. The Kenya WASH in Schools Strategy (2024–2029), for instance, outlines a financial plan to support implementation, advocating for equitable resource allocation and stakeholder contributions.

School health and education Policy gaps

Inconsistent implementation: In spite of the strengths discussed above, several gaps hinder the full realization of WASH objectives in Kenyan schools. One major challenge is the inconsistency in policy implementation across regions and institutions. While the frameworks are comprehensive, their execution is uneven, often due to limited oversight and accountability mechanisms.

Funding Challenges: Funding remains a persistent issue. Although capitation grants are intended to support WASH activities, they are frequently diverted to other uses. Moreover, some policies do not explicitly allocate budgets for WASH, which results in underfunding and stalled infrastructure development.

Limited Community Engagement: Community engagement is not effectively operationalized even though it is mentioned in several documents. Many schools lack active participation from parents and local stakeholders in monitoring and maintaining WASH facilities. This limits the sustainability and ownership of interventions.

Weak Enforcement Mechanisms: The enforcement of mechanisms is generally weak. Policies lack strong legal mandates or penalties for non-compliance. Moreover, oversight bodies are not consistently empowered or resourced to ensure adherence to standards.

Infrastructure Deficits: Infrastructure deficits are still prevalent. Numerous schools lack adequate water points, toilets, and hand washing stations. Maintenance of existing facilities is often neglected, compromising hygiene and safety.

Data Gaps and Evaluation Limitations: Data gaps also pose a challenge. While monitoring systems exist, they are not uniformly applied or regularly updated. This limits the ability to track progress, identify bottlenecks, and adjust strategies accordingly.

Menstrual Hygiene Management Integration: While Menstrual Hygiene Management is addressed in separate policies, it is not fully integrated into broader WASH strategies. The disposal systems for menstrual products are inadequate in many schools, and access to products remains uneven.

4.3.7. CONCLUSION

The document analysis reveals that Kenya has made significant strides in establishing a comprehensive and multi-sectoral policy framework to support WASH in schools. Through a series of policies, guidelines, strategies, and legislative acts enacted between 2008 and 2024, the country has demonstrated a strong commitment to fostering the health and educational outcomes of schoolchildren. These documents align with global standards such as the Sustainable Development Goals (SDGs) and reflect a rights-based approach to education and public health.

Key strengths of the policy landscape include clear institutional structures, gender-sensitive sanitation provisions, integration of hygiene education into the curriculum, and the establishment of monitoring systems linked to national data platforms. The involvement of multiple ministries and development partners further enhances the collaborative nature of WASH programs, promoting sustainability and inclusivity.

However, despite the robust policy environment, several gaps persist. Implementation remains inconsistent across regions, and funding mechanisms are often inadequate or misallocated. Enforcement of policy standards is weak, and community engagement is limited, reducing the effectiveness and sustainability of interventions. Infrastructure inequality, particularly in rural and marginalized areas, continues to hinder access to safe water and sanitation. Moreover, MHM, though addressed in standalone policies, is not fully integrated into broader WASH strategies. Closing these gaps is key to giving every learner in Kenya equal access to safe and inclusive schools.

4.3.8. RECOMMENDATIONS

To strengthen the implementation and impact of WASH policies in Kenyan schools, the following recommendations are proposed:

Increase Investment in WASH Infrastructure

Funding for building, maintaining, and improving water and sanitation facilities in schools should be a top priority for the government and stakeholders. This effort should cover sufficient hand washing areas, safe sources of drinking water, and toilets separated by gender.

Enhance Monitoring and Evaluation Systems

Strengthen data collection and reporting mechanisms by fully integrating WASH indicators into platforms like NEMIS. Regular audits and participatory monitoring involving students, teachers, and parents can improve accountability and responsiveness.

Promote Capacity Building and Training

Continuous training for teachers, school health coordinators, and local stakeholders is essential to ensure effective implementation of WASH programs. Training should include hygiene promotion, menstrual health management, and emergency preparedness.

Strengthen Enforcement and Accountability

Establish clear legal mandates and penalties for non-compliance with WASH standards. Empower oversight bodies with the resources and authority needed to enforce policy provisions at all levels.

Foster Community Engagement and Ownership

Actively involve parents, local leaders, and community-based organizations in planning, implementing, and monitoring WASH initiatives. This will enhance sustainability and promote behavioral change.

Integrate Menstrual Hygiene Management into WASH Programs

Ensure that MHM is not treated as a standalone issue but is fully embedded within broader WASH strategies. Schools should be equipped with disposal systems, access to menstrual products, and educational programs that address stigma and promote dignity.

Develop and Implement Budgeting Tools

Introduce standardized budgeting templates and guidelines to ensure that capitation grants and other funding sources are appropriately allocated to WASH activities. Transparent financial planning will support equitable resource distribution.

By implementing these recommendations, Kenya can build on its existing policy foundation hence creating safer, healthier, and more inclusive school environments that support the holistic development of every child.

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Connecting text

The previous chapter 4 presented research results to answer objective 2 of the study: To conduct a critical analysis of WASH interventions in primary schools in Uasin Gishu County, Kenya. This was phase 1B of the study. The results were presented in the form of manuscript 1-3. The next chapter five (5) and chapter six (6) presented research results for phase 2 of the study, which was aimed at developing an appropriate WASH intervention in schools. This was to be achieved by collecting and analyzing views from WASH experts applying consensus method of Delphi technique.

PHASE 2

5.0 CHAPTER 5: DEVELOPMENT OF AN APPROPRIATE INTERVENTION FOR WASH IN SCHOOLS

This chapter presented research results of PHASE 2 of the study. The objective of phase 2 of the research study was to develop an appropriate intervention for WASH in primary schools in Uasin Gishu County, Kenya. This objective was to be achieved by answering the questions on who should be involved in the implementation of WASH program in primary schools, what should be included in the implementation of WASH interventions in primary schools and how should WASH interventions be implemented in primary schools in Uasin Gishu County, Kenya. Consensus method of Delphi technique round 1 and Delphi technique round 2 techniques were used to collect data and present experts' views on planning, budgeting, coordination, implementation, monitoring and evaluation of school WASH program at the county and the sub-county levels. The results were presented in the form of manuscript number 4. The manuscript has not been submitted to any journal.

5.1 STRENGTHENING SCHOOL WASH IMPLEMENTATION: EVIDENCE FROM EXPERTS CONSENSUS IN UASIN GISHU COUNTY, KENYA

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ABSTRACT

Introduction:
Access to safe water, sanitation, and hygiene (WASH) in schools is critical for child health, learning, and gender equity. In Kenya, the Kenya School Health Policy and the Basic Education Act outline standards for school WASH; however, implementation remains uneven due to inadequate infrastructure, weak inter-sectoral coordination, and limited financing. This study aimed to identify priority components for strengthening school WASH implementation and generate policy-relevant recommendations based on expert consensus in Uasin Gishu County, Kenya.

Methods and Results:
A Delphi technique consisting of two iterative rounds was used to reach expert consensus. In Round 1, 20 purposively selected experts including head teachers, county education officials, public health officers, water and public works officers, and NGO representatives participated in key informant interviews. Emergent themes informed development of a structured Round 2 questionnaire administered through CommCare online app. Quantitative data were analyzed using descriptive statistics (means, standard deviations, percentage agreement), while qualitative responses underwent thematic coding using NVivo 12.

Experts reached strong consensus on essential components required for strengthening school WASH implementation. Key priorities included clear governance structures, designated budget lines, inclusive infrastructure, menstrual hygiene management (MHM), curriculum integration, sustained capacity building, and systematic monitoring. Multi-sectoral collaboration and recognition of best-performing schools were also emphasized as important motivators for compliance and sustainability. Equity considerations particularly the need for disability-friendly facilities and school-community outreach were highlighted as critical. Agreement levels ranged from 74% to 100%, with most items scoring mean values between 4.5 and 4.8 on a 5-point Likert scale, indicating strong consensus among experts.

Conclusion:
strengthening implementation of school WASH in Kenya requires coordinated governance, predictable funding, reliable water systems, inclusive sanitation, strengthened MHM, and consistent monitoring beyond infrastructure investment alone. Integrating these expert-validated priorities within existing national policies offers a practical pathway to improving learner health, reducing absenteeism especially among girls and promoting equitable educational outcomes.

Keywords: WASH; School WASH experts; Delphi technique; Kenya.

5.2 INTRODUCTION

Access to safe water, adequate sanitation, and hygiene (WASH) services in schools is fundamental to promoting health, educational attainment, and gender equity among learners. In Kenya, the implementation of school WASH programs has gained increasing attention due to its direct impact on school attendance, learning outcomes, and the well-being of children, particularly girls and those with disabilities (UNICEF & WHO, 2023; Ministry of Education and Health, 2018).

Despite the existence of national policies such as the Kenya School Health Policy and the Basic Education Act, many schools continue to face challenges related to inadequate infrastructure, poor maintenance, and limited funding (Ministry of Education, 2013; Ministry of Education and Health, 2018). The lack of dedicated budget lines for WASH activities has resulted in fragmented implementation, with schools often relying on donor support or ad hoc community contributions (Deroo, Walter & Graham, 2015).

Effective school WASH policies must address these gaps by establishing clear governance structures, ensuring sustainable financing, and promoting inclusive infrastructure. This includes the provision of clean water sources, modern sanitation facilities, and hand washing stations that are accessible to all learners, including those with physical disabilities (Azupogo, Dassah & Bisung, 2025). Moreover, menstrual hygiene management (MHM) must be integrated into WASH policies to support girls' education and dignity. Studies have shown that inadequate MHM facilities contribute to absenteeism and dropout among adolescent girls (Hennegan & Montgomery, 2016; World Bank Group, 2022).

The inclusion of WASH education in the school curriculum is also critical. Embedding hygiene topics in science and life skills subjects, alongside extracurricular activities such as health clubs and commemorative events, fosters behavior change and community engagement (UNICEF, 2012; Morrish & Neesam, 2021). Regular monitoring and supervision by public health officers and education inspectors are essential to ensure compliance and continuous improvement (WHO, 2023).

In summary, a robust school WASH policy in Kenya must be multi-sectoral, adequately funded, inclusive, and aligned with national education and health strategies. It should empower schools to deliver safe, healthy, and equitable learning environments for all children.

5.3 METHODOLOGY

5.3.1. Research Design

The Delphi consensus method was used in this phase of the study. Delphi is a methodology for structuring a group communication process so that the process is effective in allowing a group of individuals (experts), as a whole, to deal with complex problems with a view to providing solutions (Fawole *et al.* 2018). The process begins by questioning a group of experts on their judgment and opinions on a particular topic through a questionnaire or interview schedule, and their judgment or views are assessed; then they are given the opportunity to revise their views. This process continues until consensus is arrived at (Okoli and Pawlowski 2004).

According to (Rowe and Wright 1999), one of the key advantages of the approach, also being a main feature of Delphi techniques, is that it avoids direct confrontation of the experts by allowing the individual members the opportunity to express their opinions and judgment about a topic privately, without social pressure from dominant or dogmatic individuals or from a majority opinion. Since the researcher wished to involve experts from the school WASH program in various sub-counties and the county, school head teachers were also included as experts. Delphi technique was appropriate because each expert could freely provide their opinions privately, without meeting physically in round one of Delphi method and that Delphi technique is an appropriate method to reach consensus (Grutters *et al.* 2025).

The researcher engaged experts in school WASH program in various sub-counties and the county, school head teachers also participate as part of the expert panel responding to the two stages of the consensus Delphi process as outlined in (Fig5).

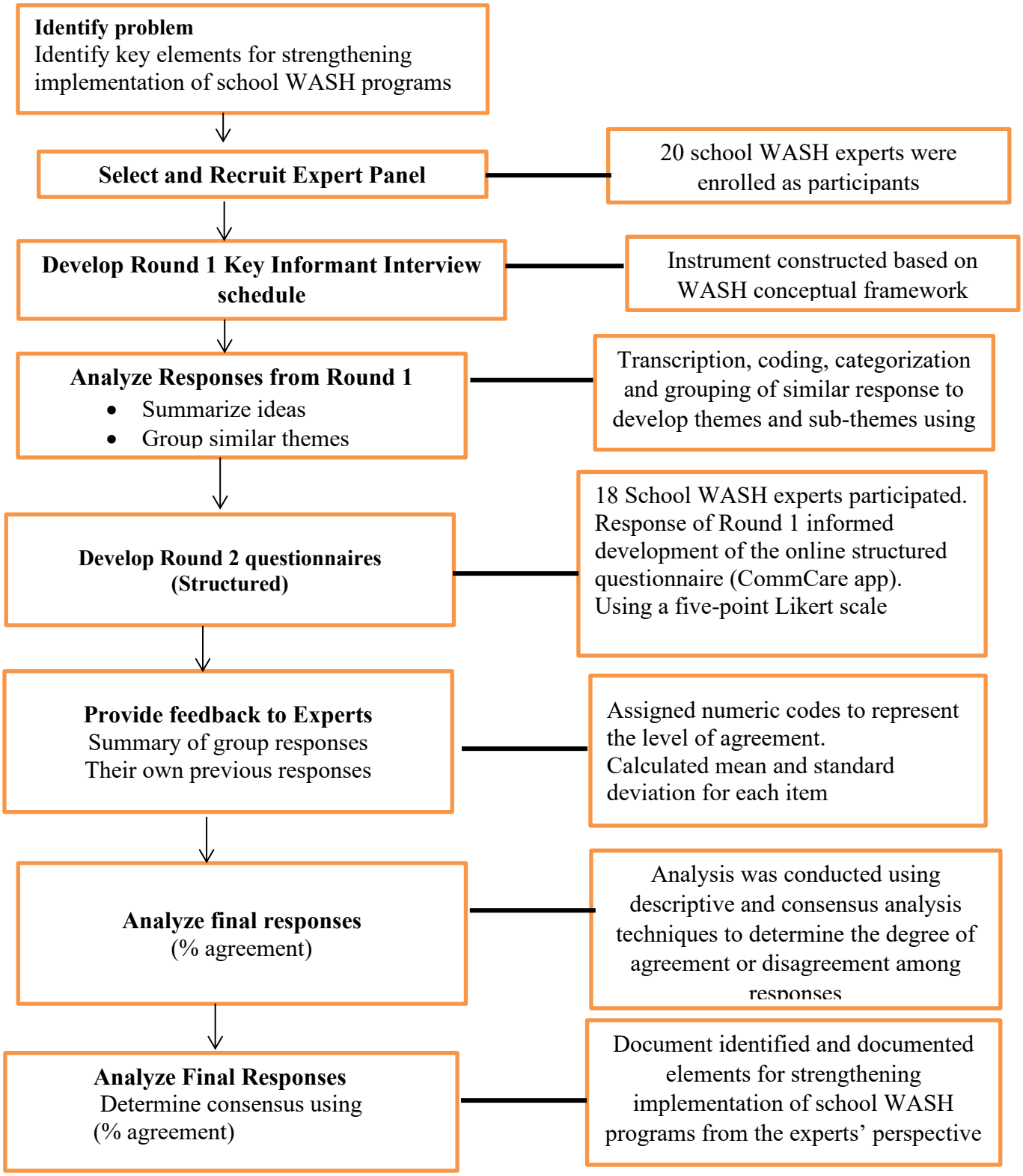


Figure 6: Flowchart of Delphi Technique process Ref : (Jorm 2025)

5.3.2. Population and Sampling

5.3.2.1. Selection of the panel of experts (key informants)

An expert is defined as a person with relevant knowledge of and experience in the school WASH program. These experts were identified by their roles and responsibilities in school WASH as outlined in the Kenya School Health implementation guidelines (Ministry of Education and Health, 2018). The following categories of experts were identified: the school head teachers, the County Educational directors, the schools' Boards of Management (BOM), the county in-charge of water department, public health officers, the county public works officer, quality assurance and standards officers, and Constituency Development Funds officer (CDF) as development partners participating in WASH activities in Uasin Gishu County.

5.3.3.2. Sample size

County management officials in charge of the school health program in Uasin Gishu County, and any other organization participating in WASH activities in the county, were purposively selected because the researcher was specifically interested in only those who participate in the WASH program. At the county and in each Sub-County, there are a few specific personnel under the department of public health in charge of the WASH program in schools engaged in WASH activities; all the personnel were involved in the study.

It is recommended that 10-18 experts be on a Delphi panel (Donohoe and Needham, 2009;

Khodyakov *et al.* 2023). However, Delphi group size does not depend on statistical power but rather on group dynamics for achieving consensus among experts (Okoli and Pawlowski 2004). According to Mchunu (2007), sample size varies and depends on the research topic. For this study, the researcher engaged only personnel who manage or engage in WASH activities in the county, many of whom are government employees.

Head teachers were also purposively sampled, as they are responsible for managing the WASH program in schools.

Delphi Round I

5.3.3. Data collection methods and instruments

Identified experts were contacted in person and invited to participate. A detailed information sheet or a cover letter explaining the study purpose, including the Delphi procedure, the level of commitment required, and the expert's participation, was included. The experts were asked to sign a consent form if they agreed to participate in the study. Delphi Round one focused on exploration of experts' views and experiences regarding school WASH program implementation. The experts were 20 in number and included head teachers, county education officials, public health officers, water and public works officers, and NGO representatives. Data was collected using an unstructured interview schedule participated in key informant interviews. In this first round, the questionnaires were unstructured to allow each expert free room to identify and elaborate on the issues they considered important (Rowe and Wright 1999).

The interview schedule was designed to gather information on the policies and guidelines in place for executing the WASH program in primary schools, planning and coordinating WASH programs in schools, financing, budgeting, monitoring, and evaluation of school WASH programs in the county, and a proposal on what needs to be done to improve WASH in schools. The instrument construction was based on the input component of the WASH conceptual framework for schools, as applied in this study, and on the appropriate research question.

The interviews (KII) were audio-recorded; the interview lasted approximately 30-40 minutes. The interviewing of participants continued until no new information was gathered; that is, when data collection stopped; this is referred to as the point of data saturation (Hennink, Kaiser, and Marconi 2017).

Delphi Round 2 aimed to validate, refine and prioritize findings from Round 1 and to establish consensus among the panel of experts. Based the analysis of Round 1 data, structured questionnaire that contained clearly defined statements representing the synthesized themes and proposed components of an appropriate school WASH intervention was developed. Participants were asked to indicate their level of agreement or disagreement with each statement using a Likert-type scale.

5.3.4. Data analysis

Audio-recorded interviews gathered in round one was transcribed verbatim into Microsoft Word. Transcripts were then imported into NVivo (version 12) for analysis. The researcher developed a coding framework based on the study objectives and interview guide and conducted deductive coding and pattern matching using NVivo to organize and categorize the data. Similar responses were grouped, and themes were developed by merging categories with related content**.**

Data from Round Two were analyzed using descriptive and consensus analysis techniques. Responses were summarized to determine the degree of agreement or disagreement for each statement derived from Round 1 themes.

5.4 ETHICAL CONSIDERATIONS

Ethical clearance was obtained from the Institutional Research Ethics Committee (IREC) of the Durban University of Technology, South Africa, and from the Ethical Review Committee of the University of Eastern Africa, Baraton, Kenya. Additional authorization to conduct the study in Kenya was granted by the Ministry of Education in Uasin Gishu County and the National Commission for Science, Technology and Innovation (NACOSTI). IREC Ethical Clearance number was (IREC 113/23)

Information sheet and letters of consent were shared with individuals invited for participation in the Delphi study and the entire study. In these letters participants were informed that their participation was voluntary and they would withdraw at any stage of the study. All experts were over 18 years of age. Survey responses were anonymous as no personal identifiers or information was required from participating individuals. Participants were then asked to sign consent forms if they agreed to participate in the study.

5.5 RESEARCH RESULTS FOR DELPHI TECHNIQUE ROUND 1

5.5.1 Demographic data of research participants

A total of 20 Key Informant Interviews (KIIs) were conducted. The results reflect data collected from government officials who are engaged in school WASH activities at the county level. Here they have been referred to as WASH experts as shown in Table 11.

Table 11: List of WASH experts in Delphi Technique Round 1

Key Informants categories	Allocated codes	Number
Sub-County Education directors	KII-EDU	3
County officer in-charge of water department	KII-ENG	1
County public works officer	KII-PWO	1
public health officers	KII-PHO	3
quality assurance and standards officers	KII-QSO	3
constituency development funds officer	KII-WPT	1
school head teachers	KII-SHT	6
school board of Management	KII-BOM	2
	Total	20

The interviews focused on the implementation of the school WASH program and on proposals for interventions to improve it in Uasin Gishu County, Kenya.

The results cover three overarching themes, namely (1) the personnel involved in implementing WASH program in schools; (2) what needs to be included in WASH policy guidelines in primary schools; and (3) how WASH policy in school.

5.5.2 View on personnel to be involved in WASH program in schools

Multisectoral collaborations

As outlined in the National School Health Strategy Implementation Plan 2011-2015, Water Sanitation and Hygiene component of the school health program has many officers from several departments being engaged in school WASH; these officers include persons from various government ministries and other stakeholders as follows: Ministries of education, Public health and sanitation, Public works, Health, Water department, constituency development officer, faith-based organizations, non-governmental organizations, school boards of management, the school head teachers, Kenya Institute of Curriculum Development and many more.

Think everyone plays a role from the government agencies, to the… the people themselves, at the community level, to even our public health department. It's a whole chain that needs to… they need to work together for the effectiveness (KII-ENG-01)

Okay, for wash program, it's a multi- sectorial thing, (shuffling noises) … it needs to be done by many, because if you work alone as a department, then we might not reach whatever is required. So, we need to have a forum of all the stakeholder, like I'd said, education should be there, health should be there, water and the environment, and the… all of us… everybody should be put on board, so that, we can achieve our… our target or whatever we want because if you work and do them in isolation then we might not achieve whatever we want (KII-PHO-02)

It should be the responsibility of everybody who will have a supervisory role in our institutions, and it should not be limited to Ministry of Education. It should go beyond (KII-QSO-02).

Beyond the Ministry of Education, even within the Ministry of Education like I've seen I'm a quality assurance, we have the administrators and some county directors, theirs should not just be management alone. They should also be empowered to a level where when they visit institutions just approach the principal's office or head teachers' office, they should be able to move around and be able to raise those issues of WASH. There are those people who are working with the Teachers Service Commission, yeah it should not just be when they go to institutions, they are just looking at issues of teacher adequacy, discipline and all that, they should also be empowered so that they are also looking at issues in that institution where their teachers are working. (KII-QSO-02)

Public private partnership

It was observed that the stakeholders at the school level were only from public schools, and a suggestion was made to include private schools as stakeholders in school WASH programs, since all school-going children, whether from public or private schools, have the right to access clean and safe WASH.

Then I also think it's good for us to mostly bring in the private entities as well, who could be having a lot more to offer, but they are not having properly laid down structures on how they can come in and help in that program KII-SHT-06

is it disinterested, then there would be no sustainability, and that's why most of the time, we talk about public private partnership, because now, we are the public, now private are the partners, and now only need to partner for sustainability. (KII-PHO-01)

Involvement of Community Health Extension Worker (CHEW) and the Reproductive health nurse I WASH. Community Health Extension Workers (CHEWs) and Reproductive Health Nurses are members of the health care system. Since (CHEW) works within the community, it was proposed that they be involved in WASH activities in schools within their jurisdiction, and the reproductive health personnel participate in MHM in schools.

The CHEW is a public health and the nurse, so that when we do the… all the information when we go to schools, if I talk about WASH, a nurse will also talk about RH, because RH with MHM is related (KII-PHO-03)

5.5.3 Element for inclusion in School WASH policy and guidelines a clear guide on the coordination of school WASH activities.

The interviewees felt that, even with the governance structure outlined in the school health policy, coordination of WASH activities was not well synchronized from the top to the bottom. It was recommended that there be clear coordination of the school health and WASH program's activities, citing examples of how activities were conducted in schools during the COVID-19 pandemic by the central and county governments.

.

you know the time of COVID, there was a very nice system and structure which was done, and you found that during that time the year 2020… 2020/21 – 2022, water, hygiene and sanitation in schools was perfect because it was well coordinated. (KII-SHT-02)

Funding of WASH program by the government

It emerged that the funding for WASH components in schools is unclear. The school health policy, strategies, and guidelines do not indicate the source of funds or whether the government is funding all WASH activities.

> *I think what should be included is there would have been a policy that talks about funding by the government, rather than leaving it open, whereby the government can decide to fund or not fund. So, if there would have been, then it would have been so many steps ahead, because it would have been part of the policy… yes. Just like the way drugs are, you know the drugs must be bought to all this and this (KII-PHO-01)*

Outsourcing of WASH services

For WASH services to be effective, it is proposed that school WASH policy and guidelines include information on outsourcing WASH services to schools, as outsourcing could improve WASH services

and ease teachers' burden, allowing them to concentrate on teaching. Some of the services recommended for outsourcing include collection and disposal of refuse and other waste, provision and maintenance of water and water resources, education of school teachers and pupils on WASH, and especially Menstrual Hygiene management to girls who reach the age of receiving their menses:

> *May be if there was a policy that every institution, every school should have water from the source that is ELDOWAS for us in Eldoret, it would help for sanitation or drinking water (KII-SHT-05)*
>
> *We have companies that will come maybe once in a week or twice and make sure that the compound is clean. What will be left there is for the management now to make sure that that cleanliness is maintained. Until the next time when they'll come back (KII-SHT-03)*
>
> *Because teachers cannot concentrate on that, and they are employed to teach. They should have people who are specialists in waters and sanitation (KII-SHT-02)*
>
> *I think sanitation in toilets, the schools should hire someone who is... who is paid. Yes, it should not be the students alone. The students can be taught on making the toilet clean, but there should be somebody who is in charge to make sure that the toilets are always clean (KII-BOM-01).*
>
> *Other schools have contracted companies to provide training to teachers on water treatment and other schools have companies contracted to provide bins for disposing sanitary towels and collecting filled bins.*

Government to provide Water to all private and public schools

Water being an essential commodity to all school-going children, it was suggested that the provision of water and maintenance of its resources should be done for both public and private schools and this should be the prerogative of the government.

> *think it has to start from the top by government and in fact even government itself relooking into the whole program of water and hygiene programs in our schools. In that to sort out these*

problems we have for example, where schools are not so well connected to the water and the services, instead of saying a school for example should separately pay for its water services to get them I thought it should be a declaration of government, that any learning institution whether it's a private one or a public one should have access to water and then they can devise ways of getting the money they needed to actually sustain the programs instead of saying if the school for example, is not able at a particular point you know to pay up for those services then they are disconnected. I think that can be a better approach (KII-SHT-06)

All schools to have sunken boreholes

To ensure a constant supply of water for hand washing, drinking, and other uses, it is recommended that all schools have sunken boreholes connected to a solar system, thereby reducing the cost of pumping water from the borehole and electricity bills.

We have a well but that one is not sufficient. Sometimes when it is dry season, we have to get enough water, yeah. So, the water should actually be drilled, yeah in school in all the schools KII-SHT-04

If it will be easier, I hope that every school should have borehole and solar power, where each school will be having its own water in the school KII-BOM-02

All schools have modern toilets with septic tanks or connected to sewerage systems.

During interviews, it was reported that the water table in Uasin Gishu County is a little high and so during the rainy season water levels in the pit latrines rise and cannot be used due to lack of safety brought by increased tendencies of toilets collapsing, the danger of splashing during use, and fear of outbreak of diseases due to overflow of human waste and contamination of water and environment. It is against this background that there are suggestions that all schools should have modern flush toilets connected to septic tanks or to the sewerage system depending on their location.

Okay, on sanitation I would say that the government also should provide modern toilets, the flash toilets rather than the pit toilets. Especially in this area, because there is a lot of water. In fact, I recently requested a head teacher that we make a report so that we recommend the flash toilets. For this school, because this is a place where the water level is… (crosstalk) So if we can have, have flash toilets, then we have a septic tank or a bio digester. That could be better. Yeah. And it could be safe for the children, but because of funds now we don't know what to do (KII-SHT-04)

If every school get its own water, source of water, my suggestion is that we should not be using pit latrines, nowadays, we should be using modern toilets whereby we should use digesters so that we avoid each and every year where toilets collapse, maybe some pupils are injured. If we use modern technology, modern toilets, the only challenge is that it requires water (KII-BOM-02)

Increase frequency of school inspection visits

The county government has sub-county quality and standards officers inspecting schools to maintain standards through the Ministry of Education. When it comes to inspection and maintenance of WASH infrastructure, the respondents recommend that it is necessary to include in the WASH guidelines the number of visits an officer needs to make to a school within a given time and also increase the frequency of school inspection visits

Then thirdly, they should have an inspection done every quarter. They should send the... government should send inspectors in schools to ensure that the hygiene, water and sanitation is in place (KII-BOM-01)

They come and inspect and also advise the school institution on how to improve the areas they have not yet improved and… and probably visit severally to make sure that whatever is being discussed is implemented because the moment they come we discuss and then they disappear, we shall also forget about it. But the moment they come regularly, we shall not be knowing that in a week time or two weeks' time, these people will come (KII-SHT- 03)

Adding WASH content to school curriculum

WASH in primary schools in Kenya is an element present in the curriculum. The three components are covered as separate entities and taught in different classes. It is suggested that WASH education content be increased in the primary school curriculum and, maybe, be taught as an independent subject.

> *Yes, it's true. I think sensitization should be included even in the education curriculum like every class every grade should have a lesson just about water and sanitation and hygiene and if possible, every month they should be just a class about that. (KII-SHT-01)*

> *So, we are proposing to the government so that maybe, they would put it in guidelines that when they are coming up with the curriculum, they should ensure that WASH comes out of the subject (KII-SHT-04)*

Increase budgetary allocation to school WASH

All schools in the county have a budget allocation from the county government for running school activities and each learner has a vote head. The head teachers indicated that the vote head is very minimal. The money is not adequate to provide and maintain WASH facilities and other activities. Since WASH activities are very essential to the learners and require a lot of resources, there is a proposal that WASH activities be allocated a vote and not be included in a general vote for the school.

> *I'm not saying that the votes is there, that if the government can really provide and specify that this water... this... this money is for water and sanitation (KII-SHT-01)*

> *No, it's not like for example what they are giving us on EWC which is electricity, water and conservancy, very little, as little as 108 shillings per term per child. So, it doesn't even pay one month's bill, yes. So, say repairs, say payment of workers and day to day consumables, it's hectic. It is God taking care of…(KII-SHT- 02)*

It's not possible. It may not be possible until and when, the National government provides enough capitation… yes (KII-SHT-02)

Ensure availability and adequate supply of sanitary towels for menstrual hygiene in schools

It emerged that there is a need for coordination in the distribution of sanitary towels to schools for Menstrual Health Management and planning to mobilize resources to support menstrual hygiene activities in schools.

The respondents indicated that the supply of the menstrual products was inconsistent and inadequate.

What the ministry can do or the county government, is to make sure that we have constant supply of water, constant supply of the sanitary pads, and maybe, once…KII-SHT-01

Availing menstrual waste disposal bins and construction of changing rooms for girls

Some schools had waste disposal bins, while others, especially public primary schools, lacked menstrual waste disposal bins and separate changing spaces for girls. It is recommended that the government provide sanitary bins and sufficient sanitary pads for schoolgirls

we have… we have after installing the bins, they have now understood, that when it is full, they are able to report. The idea of reporting is there (KII-STH-02).

Everything is okay on that side. Where to put sanitary towers and those kinds of things (KII-SHT-03).

Yes... yes. The government should also provide those enough sanitary pads for the girls. The government should provide... what do we call... like this one for Rentokil, yeah, where they can dispose, yeah, the pads after use. So, all the girl's toilet should have (KII-SHT-04)

Actually, we don't have. But remember that, this school was started long time ago, it is not a modern one, but we believe that if we are to be built another toilet, another washroom, it will have it (KII-SHT-01)

Conducting outreach and sensitization activities on MHM in schools

The experts also proposed the need for outreach and sensitization activities in schools on Menstrual Health Management.

Adaptability of all schools with facilities to meet the needs of children with special needs and disability

A component of special needs, disability, and rehabilitation is included in the school health policy, as is the adaptation of the school environment to accommodate children with mobility-related disabilities.
It emerged from the interviews that there are some categories of schools that are for children with mobility-related disabilities; in these schools there are considerations in installation of WASH facilities.

> *Okay we have categories of schools. We have the special schools. So, in, in case of the special schools, we always, it's a mandatory that the facilities are friendly to the learners with disabilities. Yes. So, they're, they're able to access(KII-EDU-01)*

It was indicated that many schools lack disability-friendly environment thus hindering admission and retention of such learners suggested that all schools and new ones should have provisions for children with mobility challenges since the government is advocating for integration in schools for all learners and social participation.

> *Yes, all the classes in the areas of water points should be friendly to those children with challenges, yes. The ramp should be made around the water points, classes, toilets, yes (KII-SHT-04)*

> *For the case of integrated schools. We, as much as possible, ensure that such facilities are provided. They may not be adequate for now. But that is where, where we are heading to. Yes (KII-EDU-01)*

Addition of technical support

The informants felt that there was need for additional technical support in implementation, operation and maintenance of school WASH infrastructure.

whatever guidelines are there suffices. If they could be any other thing to be added, that could be the technical aspect of it, the technical people should come in now but for us that suffices, I think it's adequate... it's adequate... it's adequate (KII-QSO-02)

5.5.4 Ways of implementing school WASH Policy and guidelines Commemoration of WASH days in schools

It emerged that several strategies have been employed to improve access to school WASH, raise awareness, and promote good hygiene habits among schoolchildren. Some of these activities that can be conducted in schools include commemorating WASH days such as Global Handwashing Day, Menstrual Health Management Day, World Toilet Day, and World Environment Day. One informant had this to share:

We also have World Hygiene Day. On that World Hygiene Day, they can do it in our schools, whereby they create awareness, they provide sanitary pads, they provide the soaps, they provide anything that we feel is related to the sanitation. KII SHT 01

For sensitization. So, they make it sort of a policy that on those days that are essentially related to water, sanitation is commemorated in schools KII-SHT-01

Parents and community engagement

It was mentioned that for WASH activities to succeed, communities where children come from must be engaged in WASH activities through funding school WASH activities, and parents should also be sensitized on hygiene issues; this was reported.

Since most of them require funding, I think it is upon all the stakeholders, particularly government in the sight of parents and BOM we should also chip in, community will also have its own role to chip in so that students or pupils should also participate in implementing the guidelines KII BOM 02

It is good that in CBC hygiene is, there is a subject of hygiene. Hygiene should also be taught in the community, whereby if students or pupils are taught in school, they will also... we encourage them to teach their parents or the community so that we have hygiene at home and we have hygiene at school, not only in our schools KII BOM 02

Capacity building of teachers and health promotion on WASH in the mainstream media

Though WASH is taught in the school curriculum, some informants felt there is a need to educate the teachers and learners on WASH by the county government; others felt that sensitization could be done through mass media. Informants indicated that

The county government, together with the national government, at times it is good that they send their people to come and educate us about sanitation and water and all those things. Occasionally, maybe it can be gradually or irregularly so, that we don't forget about it (KII SHT-05)

People should be sensitized through the radios, through the... through the... (someone talking in the background) through the media for everybody to get to know that it is very important for us to make sure that where we live in, is safe and the sanitation is good (KII- SHT- 01).

Regular and routine supervision of WASH in schools

It emerged that officers conducting supervision man large areas and are expected to conduct supervision of the schools within a given time frame.

...if I give an example of the quality assurance officers here in this sub county Ministry of Education, and then you'd be looking at the institutions of the numbers, like secondary schools, then you look at the primary schools, you're talking about 200 plus institutions. So, with that kind of a number definitely you're the one who is doing that and maybe it's a requirement that you

visit a school within a period of three years, so you might leave this place and go to another sub county minus visiting quite a number of those schools (KII-QSO-02)

They should be employing people to be monitoring on day to day or routine management. You should have routine management, so that they look when they to make sure that water, hygiene and sanitation is updated KII-STH-0 SOSIANI

The head teachers recommend that school supervision of WASH facilities ought to be conducted regularly, and feedback following supervision should be timely given and reports from the supervision ought to be handed over for action.

Now that one is under public health, they could be coming all the time and making sure that the sanitation is ok, write reports, take the reports to the ministry of education, may be something would be taken in seriously. But you see they come only ones may be when we call them, example we when we want a toilet or we want to construct a building, you find that that is when they come, we need a lot of regular, ok they come but they should come specifically for sanitation and also get a report and present that report to other offices so that action should be taken. Check on the water, the learners, kitchen and everything and give a report. I think something can be done(KII- SHT- 05)

We expect the public health officer to make sure that the water points are to check whether it is it has any hazard or health hazard and to give advice, yes. And to do the testing of water KII- SHT- 04.

...who are dealing with the issue of water, they should be regular visitors to those institutions. We have the public health they should not come in just to do the report in our schools (people talking in the background) but the become a routine to them. They should have a routine to go to through institutions on a regular basis to have a look at that (KII-QSO-02).

Addition of supervisory personnel

An informant reported that some officers did not do due diligence in supervision of school WASH and could just sign the visitors' book. The officers are urged to be diligent in their work. It was reported that the officers deployed for the work were also few; one school head teacher says

> *Quality and assurance standards for officers in the county are very few. They are not enough. And then. They should be doing their work diligently because we have seen in some schools they just go there; they sign the Visitor's book in the office and they leave. They don't visit those areas, especially the toilets and any other area that needs improvement for example. So, they should do their work diligently and we should have enough of those officers KII SHT 01.*

Inspection and monitoring of funded facilities in schools

It was noted that sometimes funds could be given towards WASH activities in schools and follow up on how the money was utilized and evidence of activities done is not followed up by the relevant authorities. It is proposed that the follow-up of funds be made for accountability purposes.

> *They should also make a follow up to make sure that the same money has been used in the right way KII- SHT- 01*

Recognizing and awarding best performing schools on WASH

It emerged that recognition and awarding schools with the best WASH facilities or infrastructure could motivate school management and learners to engage in WASH activities hence improving their health states. One informant had this to share

> *Yeah, they can come in big time. Like I've said, first, they should be very, very present. And then number two, they can come in to... to do appraisals, for example, where certain institutions have done so well in the implementation of those policies, they can come in, recognize those institutions, award where necessary and also identify which ones are struggling and support them*

apart from identifying those who are... who are the stumbling blocks as well in a implementation of the same policies KII SHT 06

Appointment of a schoolteacher(s) or a department to coordinate school WASH

In some schools, teachers have been appointed to be responsible for WASH activities; in others, the teacher on duty takes responsibility, while in other schools there is a department constituted to manage WASH activities.

Teacher… Teachers On Duty, Heads of Departments… yes. Those are major people who are majorly concerned being coordinated by one of my deputies (KII-SHT-02)

Board of Management to support maintenance of WASH facilities

It emerged that some of the challenges that hindered access to WASH facilities was vandalism of WASH facilities, poor maintenance and misuse of water resources; it was therefore proposed that the BOM support the maintenance of WASH facilities in their schools.

The boards of management. Yeah. The boards of management. If, if they can up, their role in ensuring the same, I think we'll be able to address that challenge (KII-QSO-03).

Delphi technique round 2

Findings from Round 1 of the Delphi technique informed the development of a structured questionnaire for Round 2. This round was geared to provide feedback to the experts, allow them to validate their responses to Round 1, indicate their level of agreement or disagreement, and re-rank their initial scores.

5.5.5 Data collection methods and instrument

The school WASH experts who participated in round 1 were again contacted by telephone or in person and invited to participate in the second round. A detailed information sheet or a cover letter explaining the purpose of the study, including the Delphi procedure, the level of commitment required, and the expert's participation, was included. The experts were asked again to sign a consent form if they agreed to participate in the study. The data collection instrument comprised structured questions derived from

processing the Round One questions using a correlation analysis approach. The findings would be grouped by user themes that have emerged, such as policy and guidelines for executing the WASH program in primary schools, planning and coordinating the WASH program in schools, financing, budgeting, and monitoring and evaluation of the school WASH program at the sub-county and county levels.

A self-administered online questionnaire was used to collect data from 18 respondents via the CommCare app, which supported offline mobile data capture. Once data are collected and an internet connection is available, the data are automatically synced to the server. The experts were then asked to indicate their level of agreement or disagreement with the presented findings and, if they wished, re-rank their responses. An Excel file was then generated and made available for download to facilitate data cleaning and further analysis.

Credibility of the results

Credibility of the results was enhanced because the experts were from different settings, different sub-counties, and anonymity of the participants was ensured.

Validity

The Delphi method employed construct validation by asking experts to assess the researcher's interpretation and categorization of the questions asked. Okoli and Pawlowski (2004) states that the fact that Delphi is not anonymous (to the researcher) permits validation unlike many surveys.

Reliability

In discussing reliability in qualitative research, many authors talk about the "confirmability" of research findings rather than replicability of research findings (Ritchie *et al.* 2013).

Reliability was ensured since the experts who were respondents in the study had a chance to review their earlier responses. While utilizing the Delphi method, experts had a chance to revise their responses.

5.5.6 Data analysis.

Data obtained from the second round of the Delphi method were analyzed to assess the degree of agreement or disagreement among respondents' (experts') responses. Data were thereafter summarized to identify *c*ategories, and the resulting findings were used to finalize the development of the appropriate school WASH intervention that had emerged from the experts' findings. Any major disagreements were resolved through consultation with the existing literature or concerned respondents to reach a consensus.

5.5.7 Ethical consideration

Information sheets and consent letters were shared with individuals who requested participation in the Delphi study and the entire study. In these letters, participants were informed that their participation was voluntary and that they could withdraw at any stage of the study. Participants were also informed that the information they provided to the researcher would be kept confidential. Participants were assured that their identities would remain confidential. Participants were then asked to sign consent forms if they agreed to participate in the study.

5.6 RESEARCH RESULTS FOR DELPHI TECHNIQUE ROUND 2

A self-administered online questionnaire was used to collect data from 18 respondents, as listed in Table 12. There was a 90% response rate since two experts that participated in Delphi Round one did not participate.

Table 12: List of Key WASH experts in Delphi Technique Round 2

Key Informants categories	Allocated codes	Number
Sub-County Education directors	KII-EDU	3
County officer in-charge of water department	KII-ENG	1
County public works officer	KII-PWO	1
public health officers	KII-PHO	3
quality assurance and standards officers	KII-QSO	2
constituency development funds officer	KII-WPT	1
school head teachers	KII-SHT	6
school board of Management	KII-BOM	1
TOTAL RESPONDENTS		18

Data was collected using the CommCare phone app that supported offline mobile data capture. Once the internet connection was available, the collected data was automatically synced to the server. An Excel file is then generated and made available for download to facilitate data cleaning and further analysis. All questions assessing agreement were measured using a five-point Likert scale ranging from strongly disagrees to strongly agree. Each response was assigned a numeric code to represent the level of agreement: 1 for strongly disagree, 2 for disagree, 3 for neither agree nor disagree, 4 for agree, and 5 for strongly agree.

The analysis of Delphi Technique Round 2 focused on assessing the degree of expert consensus and comparing this with the relative prioritization of intervention items. Data were collected using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), allowing both quantitative summarization of agreement and ranking of intervention priorities.

The mean scores provided an indication of the overall level of expert support for each intervention item. Items with higher means (closer to 5) reflected stronger agreement and were interpreted as high-consensus interventions. The ranking of intervention priorities was implicitly derived from: Higher mean scores, higher proportions of agreement and lower variability (SD) as summarized in Table 13. Thus, prioritization was based on an aggregate interpretation of consensus indicators, rather than a single statistic.

Table 13: Round 2 Delphi technique results, Experts consensus on strengthening school WASH program implementation in Uasin Gishu County Kenya

Item	Meansd	Agree
Personnel to be involved in the implementation of WASH program in primary schools		
Community health extension worker chew needs to be involved in school WASH	4.6 (SD 0.5)	100%
For WASH in schools to be a success there must be collaboration among different stakeholders including the school board, County and health coordinator	4.9 (SD 0.3)	100%
Reproductive health nurse needs to be involved in school WASH	4.4 (SD 0.8)	95%
The government to involve public and private primary schools in wash program	5 (SD 0)	95%
Interventions to be included in the WASH policy guidelines in primary schools		

Item	Meansd	Agree
Item	Meansd	Agree
Addition of wash content to school curriculum	4.6 (SD 0.5)	100%
Deployment of more quality assurance and standards officers and public heal	4.7 (SD 0.6)	95%
Inclusion of multiple health stakeholders on school wash program	4.8 (SD 0.4)	100%
Increase budgetary allocation to school wash	4.7 (SD 0.5)	100%
Increase frequency of school inspection visits	4.8 (SD 0.4)	100%
Need for partner support in implementation of the wash program in schools	4.6 (SD 0.5)	100%
Need for separate budget and funding for wash in schools	4.5 (SD 1)	95%
Newly established schools should be integrated schools -have friendly facilities	4.9 (SD 0.3)	100%
Outsourcing the maintenance of wash facilities in schools	3.9 (SD 1)	74%
The governments to fund school wash programs	4.7 (SD 0.5)	100%
Water interventions		
Item	Meansd	Agree
All schools to have sunken boreholes and water storage tanks	4.4 (SD 0.8)	89%
Government to provide water to both public and private schools within them	4.5 (SD 0.5)	100%
Water analysis - routine testing of the quality of drinking water sources; physical, chemical, and microbiological contaminants	4.7 (SD 0.5)	100%
Interventions on hygiene promotion among learners and teachers in the school		
Item	*Meansd*	*Agree*
Access to education material on wash for students both in schools and outside	4.7 (SD 0.6)	95%
Observe commemoration of important WASH days; world hand washing day, world toilet day	4.7 (SD 0.5)	100%
Introduction of health clubs and talking messages on wash in schools	4.8 (SD 0.4)	100%
Learners taken through practical on how to promote wash activities.	4.7 (SD 0.5)	100%
Outreach and sensitization activities in schools.	4.7 (SD 0.5)	100%
There is need for peer education on wash in schools.	4.8 (SD 0.4)	100%
Menstrual health management		
Item	Meansd	Agree
All schools should have menstrual waste disposal bins	4.8 (SD 0.4)	100%
Changing rooms for girls during menstruation be constructed in every school	4.8 (SD 0.4)	100%

Item	Meansd	Agree
Government to ensure availability and adequate supply of sanitary towels	4.8 (SD 0.4)	100%
Plan and carry out world menstrual day	4.7 (SD 0.5)	100%
Services for collection and disposal of sanitary towels be outsourced	4.5 (SD 0.5)	100%
Access to school WASH facilities by learners with disabilities		
Item	Meansd	Agree
All newly established schools to have ramp to easy movement of learners with disabilities	4.8 (SD 0.4)	100%
All newly established schools to have sanitation facilities appropriate for learners with disabilities	4.9 (SD 0.2)	100%
Taps height consideration and models of opening and closing the taps to be accommodative to learners with disabilities	4.7 (SD 0.5)	100%
Sanitation facilities in schools		
Item	Meansd	Agree
All schools should have flush toilets connected to septic tank for emptying when needed or the sewerage system	4.7 (SD 0.5)	100%
Schools to have staff employed specifically to ensure cleanliness of the sanitation facilities and school environment	4.6 (SD 0.6)	95%
Ways of implementing WASH policy guidelines in schools		
Item	Meansd	Agree
Best performing schools on WASH should be recognized and awarded	4.6 (SD 0.5)	100%
Government to engage both private and public schools' stakeholders on wash	4.7 (SD 0.5)	100%
Head teacher to appoint teachers or departments to coordinate school WASH	4.8 (SD 0.4)	100%

Participants generally expressed high levels of agreement with the statements presented. The mean scores for most items ranged between 4.5 and 4.8, indicating a tendency toward agreement across the board. Standard deviations were relatively low, suggesting limited variability in responses.

When examining the proportion of respondents who selected either agree or strongly agree, a substantial majority demonstrated perfect agreement on key items. Similar patterns were observed across all items, highlighting consistent support for the constructs measured.

Delphi techniques round 2 survey results reveal overwhelming support for strengthening WASH programs in schools, with nearly all proposed interventions receiving high mean ratings and agreement levels as portrayed in table 13. Stakeholder involvement is seen as foundational to success. For instance, 100% of respondents agreed that community health extension workers (CHEWs) should be involved in

school WASH, with an average of 4.6 (SD 0.5). Similarly, the results revealed collaboration among stakeholders, including school boards, county officials, and health coordinators agreement at 100% with a mean of 4.9 and SD 0.3. The inclusion of reproductive health nurses was slightly less endorsed, though still strong, with 95% agreement and a mean of 4.4 (SD 0.8). The highest possible score of 5.0 (SD 0) was recorded for government involvement of both public and private schools, with 95% agreement.

Interventions to promote and strengthen WASH in schools were broadly supported. The addition of WASH content to the school curriculum received 100% agreement and a mean score of 4.6 (SD 0.5). Deployment of more quality assurance officers and public health staff was endorsed by 95% of respondents (mean 4.7, SD 0.6). The inclusion of a diverse group of health stakeholders, greater budgetary allocations, and increased frequency of school inspections each attained unanimous support, reflected in mean scores between 4.7 and 4.8. Partner support and separate budget lines for WASH were also highly rated, with 100% and 95% agreement respectively. Notably, the idea that newly established schools should be integrated and have friendly facilities scored a near-perfect mean of 4.9 (SD 0.3) with full agreement. However, outsourcing maintenance of WASH facilities was less popular, receiving only 74% agreement and a lower mean of 3.9 (SD 1.0), indicating mixed views on privatization.

Water interventions were also prioritized. Routine water quality testing, covering physical, chemical, and microbiological contaminant was supported by 100% of respondents (mean 4.7, SD 0.5). Government provision of water to all schools received full agreement (mean 4.5, SD 0.5), while the installation of sunken boreholes and storage tanks was slightly less favored, with 89% agreement and a mean score of 4.4 (SD 0.8).

Hygiene promotion among learners and teachers was universally endorsed. Access to WASH education materials received 95% agreement (mean 4.7, SD 0.6) while commemorating global WASH days such as World Hand washing Day and World Toilet Day was supported by all respondents (mean 4.7, SD 0.5). The introduction of health clubs and WASH messaging scored a mean of 4.8 (SD 0.4) with 100% agreement. Practical sessions, outreach activities, and peer education all received full support, with mean scores ranging from 4.7 to 4.8.

Menstrual health management was another area of undivided support. All items including the provision of menstrual waste bins, construction of changing rooms, supply of sanitary towels, and celebration of World Menstrual Day received 100% agreement and mean scores between 4.7 and 4.8. Outsourcing sanitary towel disposal services was slightly less favored, though still supported by all respondents with (mean 4.5, SD 0.5).

Access to WASH facilities for learners with disabilities was strongly emphasized. All newly established schools were expected to include ramps (mean 4.8, SD 0.4) and disability-friendly sanitation facilities (mean 4.9, SD 0.2), with 100% agreement. Consideration of tap height and design to accommodate learners with disabilities also received full support (mean 4.7, SD 0.5).

Sanitation infrastructure was viewed as essential. The installation of flush toilets connected to septic tanks or sewerage systems was unanimously supported (mean 4.7, SD 0.5). Employing staff specifically for maintaining sanitation facilities and the school environment received 95% agreement (mean 4.6, SD 0.6).

Finally, implementation strategies for WASH policy guidelines were widely endorsed. Recognizing and awarding best-performing schools received 100% agreement (mean 4.6, SD 0.5). Government engagement with both public and private stakeholders was also fully supported (mean 4.7, SD 0.5). The appointment of WASH coordinators within schools scored a mean of 4.8 (SD 0.4), and capacity building for head teachers and staff received a mean of 4.7 (SD 0.5), both with 100% agreement. Follow-up on funded facilities to ensure completion was similarly supported (mean 4.6, SD 0.5). Integration of Research Instruments within the WASH FIT Logic Model

5.7 INTEGRATION OF RESEARCH INSTRUMENTS WITHIN THE WASH FIT LOGIC MODEL

The findings from structured questionnaires, observation checklists, focus group discussions, and key informant interviews were systematically integrated within a multiple-case study framework guided by the WASH FIT logic model. Each instrument addressed complementary dimensions of inputs, activities, outputs, and outcomes of school WASH interventions. Quantitative instruments established the status

and distribution of WASH resources across schools, while qualitative methods provided contextual explanations and governance-level insights as illustrated in Table 14. This triangulated approach ensured methodological rigor and produced a comprehensive evidence base that directly informed subsequent intervention development.

Table 14: Logic model-aligned research instruments for school WASH interventions

Research Instrument	Primary Research Objective(s)	Phase of Study	Data Type	Key Focus of Data Collected	Logic Model Component Addressed
Structured Questionnaire (Survey)	Objective 2: Critically analyze WASH interventions in schools	Phase 1B	Quantitative	Availability, functionality, financing, management, and coverage of WASH facilities and services	Inputs and Outputs
Observation Checklist	Objective 2: Validate status and outcomes of WASH interventions	Phase 1B	Quantitative	Physical condition, cleanliness, accessibility, inclusivity, and usability of WASH facilities	Input, activities and outputs
Focus Group Discussions (FGDs)	Objective 2: Examine implementation processes and experiences	Phase 1B	Qualitative	Teachers' experiences, implementation practices, behavioral factors, challenges, and perceptions	Activities and Outcomes
Key Informant Interviews (KIIs)	Objective 2: Analyze institutional and system level WASH implementation. Objective 3: Inform intervention development	Phase 1B & Phase 2	Qualitative	Policy implementation, coordination, financing, monitoring, institutional roles, and sustainability	Inputs, Activities, and Outcomes
Delphi Technique (Expert Consultation)	Objective 3: Develop an appropriate WASH intervention	Phase 2	Qualitative / Quantitative	Consensus on intervention components, roles, and implementation strategies	Activities and Outputs
Expert Validation Workshop	Objective 4: Validate feasibility and acceptability of the intervention	Phase 3	Qualitative	Acceptability, feasibility, barriers, and facilitators of proposed interventions	

Document Analysis	Objective 1: Map evidence of WASH interventions Objective 2: Contextualize WASH implementation	Phase 1A & Phase 1B	Qualitative	National and county WASH policies, guidelines, strategic plans, school records, monitoring tools	Inputs (policy, governance, institutional framework)

5.7 DISCUSSION OF DELPHI TECHNIQUE FINDINGS

5.7.1 Delphi Technique Round 1

The Delphi technique was employed in this study to systematically elicit and synthesize expert opinions on critical components of Water, Sanitation, and Hygiene (WASH) programs in schools, with the aim of strengthening policy, practice, and implementation within the Kenyan context. Given the persistent gaps between existing school WASH policies and their practical implementation, the Delphi method provided a structured and iterative approach for achieving informed consensus among professionals drawn from education, public health, water and sanitation, and community health sectors.

Delphi Technique Round 1 focused on exploratory input generation, allowing experts to freely articulate their views on the personnel required for effective school WASH delivery, essential elements for inclusion in school WASH policies and guidelines, and practical strategies for implementation. This open-ended first round was designed to capture a broad range of perspectives rooted in policy experience, service delivery, and field practice, thereby establishing a comprehensive foundation for subsequent consensus-building rounds.

5.7.1.1 View on personnel to be involved in WASH program in schools

Multispectral collaborations

According to the United Nations Children's Fund and World Health Organization 2023), WASH in schools requires a coordinated strategy that brings together multiple stakeholders to ensure the provision of infrastructure (hardware), hygiene education (software), and long-term operation and maintenance

(O&M). Fragmented or sector-specific interventions often result in facilities being constructed but then falling into disrepair due to inadequate use or management capacity. The Ministry of Education emphasizes multi-sectorial WASH planning, particularly involving the health, education, and water ministries, for sustainability and equity in service delivery (Ministry of Public Health and Sanitation and Education 2011; Ministry of Education, Ministry of Health, and Ministry of Water, Sanitation and Irrigation 2024). The National School Health Policy 2009 calls for teachers, school heads, and Boards of Management (BoMs) to implement WASH initiatives as part of a holistic health package. (Koelen and Van den Ban 2023) highlights that health officers are instrumental in reinforcing hygiene behavior change in schools and surrounding communities, linking school health to broader public health outcomes. According to the United Nations Children's Fund (2019), the technical expertise of water engineers and environmental health officers is necessary for ensuring functional water systems and proper waste management in school compounds. The 41st WEDC International Conference, Egerton University, Nakuru, Kenya, 2018, on transformation towards sustainable and resilient WASH services highlighted the need for education offices under the Ministry of Health to coordinate with county health and water departments to provide sustained WASH support.

Public private partnership

Disparities in WASH access between public and private schools can undermine national progress, particularly in urban and peri-urban areas where private institutions serve significant student populations. Integrating WASH standards across all school types ensures equity, uniformity, and sustained behavioral change in hygiene practices (United Nations Children's Fund and World Health Organization 2022b). The Sustainable Development Goals aim to provide universal access to WASH, and to ensure inclusive and quality education for all. Universality and equity mean meeting the WASH needs of schoolchildren in marginalized areas, vulnerable populations, and all children in public and private schools (Azupogo, Dassah, and Bisung 2025). A study appears to have heeded the call for universality in WASH provision in schools through a comparative analysis of WASH conditions in public and private schools in Kirkos

sub-city, Addis Ababa, Ethiopia. The study reported that the government provided water to both private and public schools (Deyasso and Ashenafi 2021).

Involvement of Community Health Extension Worker (CHEW) and the Reproductive Health Nurse in WASH

Community Health Extension Workers (CHEWs) serve as frontline public health workers under Kenya's Community Health Strategy. They are responsible for conducting health education and hygiene promotion at the household and community levels including schools (Riang'a *et al.* 2024).

In the USA, community health workers have been integrated in the school health system. Schools are seen as promising places to offer health programs and resources for students, parents, and staff. A few countries still employ school nurses to provide comprehensive health services, including screening and treatment in schools; however, many countries have shied away from this due to school nurse shortages and financial resource constraints, especially in low- and middle-income countries. To address these deficiencies in school health services, integrating community health workers into school settings has been used to support students' health and foster a culture of health within schools and communities (Yao *et al.* 2023).

A promising approach for strengthening school-based interventions is the incorporation of community health workers (CHWs). Evidence shows that school-based programs can lead to improved health outcomes, including reductions in weight and better asthma self-management among students. Because children spend a substantial proportion of their time in school, this setting is widely regarded as a critical platform for fostering a culture of health through the delivery of preventive services and support for chronic disease management (Harries *et al*. 2023). School-based health services have also been associated with improved academic outcomes, greater access to and use of health care, and more effective management of students' health conditions (Boldt *et al*. 2021). Within this context, CHWs can play a

key role by addressing cultural and community-level barriers, linking families to relevant community resources, and providing essential health education and screening services.

5.7.1.2 Element for inclusion in School WASH policy and guidelines

Clear guide on coordination of school WASH activities

Effective coordination of Water, Sanitation, and Hygiene (WASH) activities in schools is essential for ensuring sustainable infrastructure, healthy learning environments, and positive behavior change among learners. A coordinated WASH approach enables schools to align their efforts with national standards, allocate resources efficiently, and involve relevant stakeholders to achieve long-term impact (WHO & UNICEF, 2020). WASH, a key part of Kenya's 2018 school health policy, highlights the importance of sufficient water, hand washing stations, and sanitation facilities in schools. The 2018 Kenya school health policy outlines a school health governance structure, from the national school health inter-agency committee at the national level to the school health committee at the school level. (UNICEF, 2025) recommends joint governance systems across sectors, shared planning, budgeting, execution, and review, and coordination mechanisms to maintain integrated service delivery.

Funding and budgetary allocation to school WASH by the government

Many schools in Kenya, especially in rural and marginalized areas, lack adequate WASH facilities due to limited financial capacity. Government funding helps address this disparity, ensuring all learners, particularly girls and children with disabilities, benefit from safe WASH services (United Nations Children's Fund and World Health Organization 2023). One-off donor-funded projects often collapse after project closure. A policy-mandated government budget allocation ensures the continuous operation, maintenance, and improvement of WASH infrastructure in schools. Government funding ensures equity in the provision of WASH services. In the absence of public investment, schools in poor or remote communities are left behind, exacerbating disparities in health and education. By prioritizing government funding, policies can guarantee that all children, regardless of their socio-economic or geographic background, have access basic WASH services such as clean water, toilets, and hygiene education

(Akanzum and Pienaah 2023). According to the United Nations Children's Fund and the World Health Organization (2023), a lack of funding is a primary barrier to achieving universal WASH access in schools, especially in sub-Saharan Africa. The Basic Education Act 2013 underscores the government's obligation to provide a conducive learning environment, including adequate WASH services, as part of the right to education (Ministry of Education 2013).

The National School Health Interagency Committee in Kenya is in charge of creation of budget line for school health program, resource mobilization and budgetary allocation through respective government ministries, departments, stakeholders and development partners as stated in the Kenya School Health Policy 2018 (Ministry of Education and Ministry of Health 2018).

It is stated that there are three main sources of financing for WASH in schools: the government, non-state actors, and users or communities. WASH in schools is costed using the Activity-Based Costing (ABC) method. ABC is a method of allocating costs to products and services. Though there are clear guides on who is responsible for budgetary allocation in Kenya's school health policies, guidelines, and government documents, school WASH in Kenya remains underfunded, largely because many counties lack explicit WASH targets clearly spelled out in the integrated development plans. As a result, school WASH programs are not prioritized in county-level funding allocations (Ministry of Education, Ministry of Health, and Ministry of Water, Sanitation, and Irrigation 2024). As reported earlier from other researchers in this study, it is observed that many countries have policies, guidelines and other government documents on WASH in schools that bear the following characteristics: the school WASH is underfunded, sporadically enforced, the budget line items are usually reserved for building WASH infrastructure only and do not include on-going costs of operations and maintenance of school WASH (Deroo, Walter and Graham 2015).

There is no specific budget allocation in any ministry or in city or town authorities for school water, hygiene, or sanitation, as reported in the Kenya Environmental and Sanitation Policy. According to Sharma *et al.* (2024a) and McMichael (2019), inadequate funding for water, sanitation, and hygiene in schools leads to negative consequences, including inconsistent water supply and poorly maintained,

unmanaged hygiene and sanitation facilities. These consequences ultimately impact school attendance, pupils' health, learning outcomes, and educational achievements. To ensure adequate financing for school WASH, Tseole *et al.* (2022) and Girmay *et al.* (2023) recommend that the government allocate a dedicated budget for school WASH programs.

Outsourcing of WASH services

The outsourcing of WASH services allows schools to focus on their core mandate, that is, teaching and learning, while delegating specialized WASH functions to trained and professional service providers. This approach has proven successful in several low and middle-income countries. In Uganda, for example, partnerships with private operators led to improved latrine maintenance and regular water supply in schools. Many school administrators lack the technical capacity or time to properly manage complex WASH functions such as latrine desludging, waste disposal, or menstrual waste management (United Nations Children's Fund 2019). Findings from a randomized trial conducted in Nairobi, Kenya, comparing sanitation delivery modalities by the government and the private sector confirmed that the private sector provided quality facilities and services to schools at a lower cost than those provided by the government (Bohnert *et al.* 2016).

UNHCR and OXFAM established that sustainable service delivery models recommend that government institutions adopt more professional management models for WASH sectors. One of the models discussed proposes hiring experts or contracting private companies to deliver services efficiently to an agreed staff performance level, thereby easing the management burden on the user (UNHCR and OXFAM 2018). Additionally, it is stated that outsourcing these tasks can increase reliability, reduce facility downturns, and improve compliance with public health standards (World Bank 2023).

Government to provide Water to all private and public schools

The government's obligation to provide water to all schools is grounded in both constitutional mandates and international commitments. Article 53 of the Constitution entitles every child to the right to basic education; within that framework, a safe and healthy learning environment is essential, and clean water is indispensable for achieving it (Government of Kenya 2022). According to the United Nations Children's Fund and World Health Organization 2022a), only 38% of primary schools in Kenya have access to basic drinking water services. The Ministry of Education has committed to prioritizing school WASH infrastructure. The policy specifically calls for integrating school water supply into national water development plans and expanding coverage through public funding, water trucking, boreholes, and connection to municipal supplies (Ministry of Education, Ministry of Health, and Ministry of Water, Sanitation, and Irrigation 2024).

All schools to have sunken boreholes water source.

Groundwater from boreholes has emerged as a practical and sustainable solution to water insecurity in school settings. It is estimated that about 75%-90% of the world's population consumes groundwater, as it is generally an excellent source of drinking water (Abdoulaye *et al.* 2022). In addition to being a safe source of drinking water, it is also considered a reliable source of water. It is reported that institutions, such as schools, have shifted from tap water supply to boreholes as a strategy to cope with the unreliability and failures of state-owned water facilities (Wami *et al.* 2022). Groundwater is considered an improved and reliable water source that can prolong schooling for girls, since girls are more likely than boys to be responsible for water collection; on the other hand, the girl child will not miss school due to the unreliability of water during menstruation. According to reports, improving access to water can help lower absenteeism by decreasing the number of children affected by waterborne illnesses (Shimamura *et al.* 2022). According to a study by Afolabi *et al.* (2022), school enrollment increased in communities where boreholes were drilled. Of the 5 schools included in a study conducted in Guinea, 3 were reported to use boreholes as their only drinking water source (Bah *et al.* 2022). In Ethiopia, a longitudinal study found that schools with functional boreholes experienced a 26% drop in absenteeism,

particularly among girls, attributed to easier access to water for drinking, hand washing, and menstrual hygiene (Jo-Anne Lee *et al.* 2018).

All schools have modern toilets with septic tanks or connected to sewerage systems.

Improved, or modern, sanitation facilities are designed to prevent human contact with excreta through hygienic containment and disposal systems. These facilities include composting toilets, pit latrines fitted with slabs, ventilated improved pit (VIP) latrines, and flush or pour-flush toilets connected to pit latrines, septic tanks, or sewer networks (Byansi *et al*. 2025). The WHO/UNICEF Joint Monitoring Program defines basic sanitation in schools as the provision of such improved toilets that are consistently available, functional, private, and separated by sex (United Nations Children's Fund and World Health Organization 2024)

The right to education of every child is enshrined in the Kenyan constitution, and this right includes learning in an enabling environment. Odeku (2022) an intervention research study recommends the total eradication of pit latrines in all South African schools, especially those located in rural areas and informal settlements. The author contends that education includes access to proper facilities, noting that poor sanitation like pit toilets is insufficient. Adequate toilets should be modern, hygienic, and safe; a pour-flush toilet is recommended for its water efficiency and improved user experience. Another research in Kampala, Uganda, also proposes a waterborne sanitary facility that is cheaper to construct and uses less water. It is reported that channel-flush toilets use a channel as a receiving chamber for fecal matter, which is flushed intermittently to the septic tank or bio-digester. Schools use about 4 liters per child per day for flushing toilets, leading to a 90% reduction in water use. Emptying has been reduced from 30 cubic meters to 5 cubic meters per year (Byansi *et al.* 2021).

Increase frequency of school inspection visits

Increasing the frequency of school inspection visits is a critical step to enhancing the effectiveness and sustainability of WASH programs in Kenyan schools. Regular inspections serve as a monitoring and

accountability mechanism to ensure compliance with national WASH standards, identify gaps, and support continuous improvement (World Health Organization 2023). According to the 2008 safety manual for schools in Kenya, the quality assurance and standards officers conduct routine advisory visits in schools using a monitoring instrument to determine process outcomes and school safety. Teachers or assigned persons in charge of water, sanitation, and hygiene will observe WASH facilities on a day-to-day basis using an observation checklist or schedule (Ministry of Education 2008). Some of indicators for monitoring WASH in schools as outlined in the guidelines on Health and Safety Protocols for Reopening of Basic Education Institutions amid Covid-19 Pandemic 2020 and the Kenya School Health Implementation Guideline 2018 include the following: number of schools connected to existing piped schemes, number of shallow wells constructed, number of boreholes constructed, number of schools with rainwater harvesting facilities, number of schools with new toilets constructed, number of schools with rehabilitated toilets, number of schools with toilets for special needs (disabilities) constructed, number of girls receiving menstrual hygiene products and missing lessons due to menstruation, number of schools with learners, parents and partners mobilized, number of IEC materials developed, number of school staff and stakeholders trained, and school performance evaluation award scheme established (Ministry of Education 2020); (Ministry of Education and Health 2018). Regular monitoring and inspection are essential to the delivery of a safe learning environment, may help in the identification of maintenance needs, hygiene behavior gaps, and can help prevent outbreaks of WASH-related diseases such as diarrhea, cholera, and respiratory infections by ensuring water quality and hygiene practices are adhered to in schools (United Nations Children's Fund 2019). However, regular monitoring is hindered by a lack of adequate human resources and insufficient WASH funding in schools (Antwi-Agyei *et al.* 2017).

Adding WASH content to the school curriculum

According to the World Health Organization (2023), children who are taught about hygiene and sanitation in school are more likely to practice these behaviors and to influence their families and communities, thereby creating a ripple effect. Embedding WASH in the curriculum ensures that hygiene

education is systematic, age-appropriate, and consistent. (United Nations Children's Fund 2019) emphasizes that curriculum-based WASH education supports the development of life skills such as decision-making, responsibility, empathy, and personal health management. In a review of Kenyan primary school books on WASH content, it was discovered that information on water and water safety, personal and environmental hygiene was included in the textbooks used for teaching from grade 1 to grade 8; however, it is reported there were gaps in hygiene, hand washing, menstrual hygiene, sanitation and related disease exposures (Anthonj *et al.* 2021). In contrast to the perspective that textbooks used in schools contain gaps, Morrish and Neesam (2021) report, based on a study conducted in Kenya concerning the coverage of hygiene and disease prevention topics within the national curriculum, that the Science Curriculum for Primary Schools (Basic 1–6) includes substantive disciplinary knowledge and skills relevant to hygiene and disease transmission.

Supply of sanitary towels, availability of changing rooms and disposal bins for menstrual hygiene in schools

A new global report from the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) reveals major gaps in menstrual health and hygiene in schools worldwide. According to the report, globally, only 2 out of 5 schools (39%) provide menstrual health education, and less than 1 in 3 schools (31%) have bins for menstrual waste in girls' toilets. This drops to 1 in 5 schools in Least Developed Countries (17%) and to only 1 in 10 schools (11%) in sub-Saharan Africa. It is also reported that menstrual products are not always readily available, with many unable to afford them. In sub-Saharan Africa, for example, only 1 in 8 schools (12%) provide menstrual materials for free or for purchase (United Nations Children's Fund and World Health Organization 2024).

According to the United Nations Children's Fund (2019), gender inequality, discriminatory social norms, cultural taboos, poverty, and lack of basic services like toilets and sanitary products can all cause menstrual health and hygiene needs to go unmet. These have far-reaching negative effects on the lives of menstruating girls, like restricting their mobility and freedom of choice; it may affect school attendance and participation, compromise their safety, and cause stress and anxiety.

Kenya is at the forefront of MHM advocacy. The Ministry of Education has developed the menstrual hygiene management strategy 2019-2024 with the goal of addressing the needs of girls and women and providing a vehicle to transform MHM in Kenya. Some clauses in the policy include introducing tax reforms on menstrual hygiene products to make them more affordable (Ministry of Education, Ministry of Health, and Ministry of Water, Sanitation, and Irrigation 2024). Although national policies on menstrual health have improved, women and girls in Kenya still struggle to manage their menstrual hygiene safely (World Bank Group 2022).

Menstrual Health Management in schools is not only a hygiene issue but a matter of gender rights and educational equity. According to the World Bank Group (2022), adequate menstrual health hygiene requires: female-friendly facilities, information on sexual and reproductive health, and affordable, quality menstrual products. Provision of female-friendly facilities in schools entails: having gender-separate toilets or sanitary facilities, with discrete facilities for changing the soiled sanitary towels. There should be spaces for taking a bath if needed. It is stated that disposal facilities should also be provided in the girls' changing rooms instead of girls putting soiled sanitary towels in the open pit latrine, where sanitary products or blood may be revealed when the girls are menstruating, resulting in embarrassment and stigma (Hennegan and Montgomery 2016). The lack of designated space for sanitation during menstruation is demonstrated by the findings of a study conducted in India, which showed that nearly 50 per cent of girls did not have access to a separate place for bathing or changing the menstrual absorbent (Goli *et al.* 2020).

Many countries have improved school curricula to provide comprehensive sexual reproductive health education, ensuring girls, boys, and teachers are equally informed and able to support effective MHM for girls. (Chinyama *et al.* 2019; Andargie and Tinuola 2025) report that improving understanding of menstruation, such as knowledge on menstrual cycle and hygiene requirements, is postulated to improve MHM practices, self-efficacy, and reduce anxiety.

Research indicates that inadequate school sanitation and limited access to quality sanitary products contribute to lower enrolment, increased absenteeism, and higher dropout rates among girls (Nwachukwu *et al.* 2025). In an Ethiopian study, 79.2% of girls missed 1–2 days of school and 20.8% missed 3–5 days due to menstrual hygiene issues such as dysmenorrhea, fear of staining, and lack of sanitary pads (Habtegiorgis *et al.* 2021). Similar results regarding reasons for absenteeism were reported in a study that assessed the effects of a 6-month school-based menstrual hygiene management (MHM) program. Thirty-one (31%) of the girls in the control group reported missing school due to a lack of sanitary pads, compared with 7.8% in the intervention group (Andargie and Tinuola 2025).

Conducting outreach and sensitization activities on MHM in schools

The experts also proposed the need for outreach and sensitization activities in schools on Menstrual Health Management. Sensitization ensures that girls understand what menstruation is, how it is managed hygienically, and how to seek help when needed (United Nations Children's Fund and World Health Organization 2020). Studies show that girls who receive MHM education are more likely to use safe products, practice proper hygiene, and attend school during their period (United Nations Children's Fund and World Health Organization 2024). Male involvement in MHM impacts positively on health and educational outcomes of girls in schools. Sensitizing boys, male teachers, and communities on menstrual health reduces stigma and builds collective responsibility for supporting menstruating girls. A survey in Northern Tanzania found that sensitizing boys led to less teasing and greater empathy (Benshaul-Tolonen *et al.* 2020).

Adaptability of all schools with facilities to meet the needs of children with special needs and disability

The United Nations Sustainable Development Goals (SDGs) aim to provide universal access to safe water and sanitation, including equitable WASH facilities in schools for vulnerable groups like persons with disabilities (Dassah and Bisung 2023). Physical barriers such as steep pathways, narrow doorways, high ramps, long distances, slippery floors, and inaccessible hand washing stations make it difficult for pupils

with physical disabilities or mobility impairments to access these facilities (Azupogo, Dassah and Bisung 2025; Dassah and Bisung 2023).

Persons with physical disabilities may need mobility aids like wheelchairs, tricycles, or walking sticks, and some require assistance such as crutches or handrails due to limited movement or coordination. The UN Convention on the rights of people with disabilities ensures equal access to social services and education, yet in low- and middle-income countries, 90% of children with disabilities do not attend school and have attendance rates 10% lower than their peers (Azupogo, Dassah and Bisung 2023). Studies show these children have lower enrolment and attainment, with country-specific data indicating that 17% in Zambia and 78% in Guinea do not attend school (Wilbur, Dreibelbis and Mactaggart 2024).

One of the components of the Kenya school health implementation guidelines is to promote and enhance education and health right for learners with special needs and disabilities. The guidelines indicate that the Ministry of Education in conjunction with the Ministry of Health shall provide conducive, safe, accessible learning environment for all learners (Ministry of Education and Health 2018). Though the government has well spelt out what needs to be in place in schools to meet the needs of the disabled learners and those with special needs, evaluation of available infrastructure for learners with disabilities from this study findings indicate that a handful of schools have disability friendly learning environments.

As it stated by Dassah and Bisung (2023), many nations have policies and guidelines that give guidance on what should be put in place to make disability-friendly environment, but these policies are not given the needed attention to ensure implementation. The author suggests that limited resources or a lack of motivation to follow policies may contribute to the insufficient provision of disability-friendly facilities in schools. Ensuring fair access to education in low- and middle-income countries requires building new WASH (Water, Sanitation, and Hygiene) facilities, upgrading existing ones, and making sure these are accessible for people with disabilities, sensitive to gender, and safe, inclusive learning environments for everyone (Azupogo, Dassah and Bisung 2025). The importance of integrating children with disabilities into schools is highlighted in international agreements like the United Nations Convention on the Rights (2006), the Salamanca Statement (1994), and the UN's Sustainable Development Goals for 2030 (Bani

Odeh and Lach 2024). Governments should promote school integration to meet global standards and align with these international initiatives.

Health promotion in schools

The Ministry of Education, in partnership with the Ministry of Health, has established requirements for WASH promotion in schools through relevant policies and government documents. These include introducing health clubs, encouraging schools to commemorate WASH-related days (such as Global Hand washing Day, MHM Day, World Toilet Day, and World Environmental Day), incorporating WASH education as a key component of the curriculum, and organizing outreach and awareness activities within both school environments and nearby communities (Ministry of Education and Ministry of Health 2018; Ministry of Education, Ministry of Health and Ministry of Water Sanitation and Irrigation 2024; Ministry of Health 2024). Inclusion of WASH education in the school curriculum is the only intervention that had been implemented in Kenyan schools and a few schools having health clubs as reported by the results of this study. Health promotion initiatives in schools generally fall into two categories: those that focus on individual health factors -knowledge, skills, and habits- and those aimed at shaping environmental influences, such as social and physical settings within schools, families, or communities (Mukamana and Johri 2016). In developing countries, where health literacy is low and resources are limited while disease rates are high, health-promoting schools play a crucial role. School-based health promotion is increasingly recognized as essential for advancing children's health awareness, fostering healthier behaviours, and contributing to their academic success (Pérez-Jorge *et al.* 2021).

5.7.1.3 Ways of implementing school WASH Policy and guidelines

Commemoration of WASH days in schools

School WASH days have been listed in the Kenya school health implementation guidelines for 2018, including Global Hand washing Day, Menstrual Hygiene Day, World Environment Day, and World Toilet Day (Ministry of Education and Health 2018).

According to the United Nations Children's Fund (2012), celebrating WASH days in schools increases learners' understanding of the link between hygiene and health outcomes, enhances knowledge retention, and provides an interactive learning environment. Events typically include hand washing demonstrations, sanitation-themed skits or songs, poster competitions, health talks by public health officials, and community clean-up exercises. These activities, when done consistently and creatively, help cultivate lifelong hygiene behaviors among pupils. (United Nations Children's Fund and World Health Organization 2023) emphasizes that such events play a critical role in catalyzing long-term behavioral adoption, particularly among school-age children who are highly responsive to experiential learning. In Kenya, several NGOs and county governments have partnered with schools to mark these days, integrating activities such as sanitary pads distribution for menstrual hygiene awareness and competitions on water conservation to promote environmental responsibility, education on oral hygiene and distribution of toothpaste and tooth brush and hand washing On Global Hand Washing Day, CHEWs often lead live demonstrations, while companies may donate soap, tippy taps, or hand washing posters (Peters *et al.* 2019). Commemorating WASH in schools is important because it raises learners' awareness of WASH practices and can lead to behavior change that promotes children's well-being, prevents disease, and improves learning outcomes (Centers for Disease Control, 2024). Despite the school WASH provisions in school health policies and support from Non-Governmental Organizations to facilitate WASH in schools in Kenya, few schools, according to these research findings, reported being aware of and commemorating WASH days in schools. As mentioned earlier, many governments provide policies, but they are not implemented. This has been attributed to inadequate financial resources and to a lack of attention or motivation to implement the policies (Azupogo, Dassah, and Bisung 2023). Okesanya *et al.* (2024) state that insufficient government engagement; weak administrative institutions and limited stakeholder collaboration hinder policy implementation.

Recognizing and awarding best performing schools on WASH

Recognizing and awarding schools that demonstrate exemplary performance in WASH implementation is a strategic and motivational approach to strengthening WASH compliance, promoting innovation, and

sustaining hygiene behaviors in educational settings (McMichael 2019; Charnley 2022). This recognition strategy is consistent with the National School Health policy and the WASH in Schools Implementation Guidelines, which encourage the adoption of behavior change communication (BCC) strategies and school-led initiatives to promote healthy environments (Ministry of Education and Ministry of Health 2018). According to UNICEF (2020), performance-based rewards in school health programs have been effective in increasing school participation in hygiene campaigns, improving facility maintenance, and fostering pupil engagement.

Some ways to recognize and award schools with exemplary water, sanitation, and hygiene practices include presenting formal awards, holding recognition ceremonies, and organizing WASH-related competitions (McMichael 2019; Bikram and Mishra 2022). In 2019, Odisha state in India, in its demonstration of commitment towards WASH in schools, launched the "Odisha Clean School Award". This was to be an annual event to assess and rank schools on WASH. This annual award event was to recognize and to motivate schools in the state to meet the WASH service level standards for schools as defined under the national Swachh Bharat Swachh Vidyalaya initiative. The International Rescue Committee recommends that assessments involve external evaluators (e.g., public health officers), internal school committees, and parent representatives to ensure transparency and community ownership (International Rescue Committee 2020). In Kenya, awards like this help encourage meeting standards such as ensuring safe drinking water is available, maintaining clean and accessible toilets, providing working hand-washing stations with soap, supporting menstrual hygiene regularly, and including children with disabilities.

5.7.2 Discussion of Delphi technique round 2

Delphi technique round 2 produced a strong, practice-oriented consensus on what is required to strengthen the implementation school WASH program in Uasin Gishu County. Experts agreed on the need for multi-sectoral governance; dedicated, ring-fenced financing; reliable water supply; upgraded, inclusive sanitation; robust menstrual health management (MHM) systems; and strengthened supervision and accountability. These priorities echo Kenya's policy intentions but expose persistent implementation

gaps that limit equity and sustainability of school WASH services, particularly for girls and learners with disabilities (Ministry of Education and Ministry of Health 2018; United Nations Children's Fund and World Health Organization 2022; Ministry of Education, Ministry of Health and Ministry of Water Sanitation and Irrigation 2024).

Quantitatively, Round-2 ratings were clustered at high agreement (means 4.5–4.8 on a 5-point scale, low SDs), with 95–100% endorsement on core items such as multi-sectoral collaboration, disability-inclusive designs, curriculum integration of hygiene, increased inspection frequency, and dedicated budget lines. This pattern was consistent with international evidence that infrastructure alone is insufficient without strong governance, monitoring, and recurrent financing that cover operation and maintenance, consumables (soap, water treatment, cleaning supplies), and MHM commodities (Deroo, Walter and Graham 2015; United Nations Children's Fund and World Health Organization 2022).

Governance, roles, and stakeholder engagement

Experts called for clear vertical coordination from national to school level, citing the highly organized inter-governmental approach observed during COVID-19 as proof of what coordination can achieve in the short run. They endorsed a broadened constellation of actors in education, health, water, public works, quality assurance, boards of management, CHEWs, reproductive health nurses, and development partners with explicit roles and shared accountability. Inclusion of private schools was emphasized to avoid dual standards in access and to align with universal service principles embedded in Kenya's Basic Education Act and School Health Policy (Ministry of Education 2013 ; Ministry of Education and Ministry of Health 2018; United Nations Children's Fund and World Health Organization 2022).

Financing and sustainability

A recurring thread across interviews and consensus ratings was the inadequacy and fragmentation of current financing. Experts recommended creating a dedicated WASH budget line at school and county levels, rather than including WASH under broad votes that are quickly depleted by utilities and emergencies. This reflects global analyses that underfunding and lack of recurrent O&M budgets

undermine functionality and service levels, even where infrastructure exists (Deroo, Walter and Graham 2015; United Nations Children's Fund and World Health Organization 2023).

Outsourcing selected services e.g., desludging, solid waste and menstrual waste management, periodic deep-cleaning, and targeted training was strongly supported to improve reliability and relieve teachers of technical burdens, consistent with comparative evidence showing efficiency gains when specialized providers are engaged (Bohnert *et al.* 2016; World Bank Group 2022).

Reliable water supply

The panel strongly favored school-based boreholes with solarized pumping and adequate storage to overcome intermittency and billing shocks from utility networks. This reflects experience in many East and West African school systems where boreholes, when safely sited and maintained, stabilize hand washing, drinking, and cleaning, and reduce absenteeism especially for girls during menstruation. Experts also underscored routine water quality testing to ensure safety for consumption and hygiene (Abdoulaye *et al.* 2022; Bah *et al.* 2022).

Sanitation infrastructure and service models

Given high water tables in parts of Uasin Gishu and recurrent structural failures of pit latrines, experts prioritized transition to improved, water-flush solutions connected to septic tanks or sewer lines, or to water-saving, waterborne alternatives where feasible. This is consistent with rights-based arguments that unsafe pits compromise dignity and safety, and with emerging models that drastically reduce per-capita flushing volumes while improving cleanliness and durability (Odeku 2022; Byansi *et al.* 2025). The consensus further endorsed employing paid staff responsible for routine cleanliness to ensure daily service levels are maintained.

Menstrual health management (MHM)

The study highlights MHM as both a health and equity imperative. Experts reported inconsistent pad supplies, limited disposal options, and inadequate privacy for changing, and they endorsed comprehensive measures: reliable provision of menstrual products, disposal bins in girls' toilets, gender-sensitive changing rooms, and contracted services for safe waste handling. This aligns with recent

global monitoring that documents large gaps in MHM education, facilities, and product availability in low-resource settings, and with evidence linking improved MHM to attendance and psychosocial outcomes (Hennegan and Montgomery 2016; World Bank Group 2022; United Nations Children's Fund and World Health Organization 2024).

Disability inclusion and universal design

Experts strongly supported making all new schools and progressively existing schools' disability-friendly, citing ramps, accessible toilet compartments, handrails, and tap heights and mechanisms suited to a range of mobility and grip needs. This echoes SDG commitments and Kenya's policy framing on inclusion, and responds to well-documented barriers that prevent learners with disabilities from safely accessing WASH spaces and from remaining in school (Azupogo, Dassah and Bisung 2023; Dassah and Bisung 2023; Wilbur, Dreibelbis and Mactaggart 2024; Azupogo, Dassah and Bisung 2025)

Health education, curriculum integration, and behavior change

Although hygiene topics are included in the curriculum, experts emphasized the need to deepen curricular content, reinforce learning through school health clubs, and leverage commemorative WASH days for experiential learning and community engagement. The experts also supported sustained teacher capacity-building and use of mass media for wider health promotion. These recommendations are aligned with evidence that school-based health promotion must couple individual behavior approaches with supportive environments to translate knowledge into sustained practice (United Nations Children's Fund 2012; Mukamana and Johri 2016; Morrish and Neesam 2021).

Monitoring, supervision, and accountability

The panel identified supervision as a cornerstone of implementation but noted staffing shortages, heavy workloads, and infrequent visits that limit problem-solving and feedback loops. Recommended actions included increasing the number of quality assurance and public health officers, establishing minimum inspection frequencies, standardizing tools and reporting pathways, and ensuring follow-up on funded works for accountability. Recognition and awards for best-performing schools were proposed to create

positive competition and accelerate adoption of good practice an approach consistent with behavior change communication and performance-based incentives used in school health programs (McMichael 2019; International Rescue Committe 2020).

Community and parental engagement

Experts stressed that community buy-in and parental contributions financial, in-kind, and behavioral are indispensable. Extending WASH messages to households through learners and CHEWs can harmonize norms at home and school, creating a reinforcing environment for hygiene practices. This complements Kenya's competency-based curriculum orientation and situates schools as hubs for community health promotion (Ministry of Education and Ministry of Health 2018; Riang'a *et al.* 2024).

Implications for policy and practice

First, Kenya's existing frameworks already support the priorities identified by experts; the task ahead is operationalization. Creating protected WASH budget lines that explicitly cover O&M and MHM supplies would correct a key structural weakness in financing. Second, adopting universal design standards for all new builds and prioritized retrofits would advance disability inclusion and compliance with SDG commitments. Third, institutionalizing minimum inspection frequencies, standard tools, and feedback timelines could strengthen accountability. Fourth, structured partnerships with private providers for specific services guided by clear performance metrics can improve continuity while public capacity matures. Finally, a national or county-level recognition scheme for WASH-performing schools could entrench incentives for sustained improvement (Ministry of Education and Ministry of Health 2018; United Nations Children's Fund and World Health Organization 2024).

5.7.3 Comparison of Delphi technique round 2 findings in with other WASH global frameworks

The findings from Delphi Technique Round 2 demonstrate strong and consistent expert consensus on the key components required to strengthen school Water, Sanitation, and Hygiene (WASH) program implementation in Uasin Gishu County. High mean scores, low standard deviations, and near-universal agreement across most items indicate robust consensus among experts. When compared with WHO

WASH in Schools guidelines, UNICEF WASH frameworks, and prior Delphi studies, the findings show both strong alignment with existing evidence and important context-specific contributions.

Alignment of Delphi technique findings with WHO WASH in Schools Guidelines

The findings align closely with WHO recommendations, particularly regarding multi-sectoral collaboration, hygiene promotion, infrastructure provision, and inclusive WASH services. The strong consensus on stakeholder collaboration (mean 4.9, SD 0.3; 100% agreement) reflects WHO's emphasis on coordinated action between the education and health sectors (WHO, 2023). This suggests that global recommendations are not only theoretically valid but also practically endorsed by local experts.

Similarly, strong agreement on hygiene promotion interventions such as WASH education, school health clubs, and peer education (means 4.7- 4.8) supports WHO guidance that prioritizes behavioral change alongside infrastructure provision (WHO and UNICEF, 2019). These findings reinforce that infrastructure alone is insufficient without sustained behavior change strategies.

In relation to service delivery, the findings correspond with WHO standards defining essential WASH services as access to safe water, sanitation, and hygiene facilities (WHO/UNICEF JMP, 2024). However, the study extends these recommendations by identifying routine water quality testing as a key priority (mean 4.7, SD 0.5; 100% agreement), highlighting a shift toward quality assurance and continuous monitoring.

The emphasis on menstrual health management (MHM) and disability inclusion further reflects WHO priorities for equitable WASH access (WHO, 2023). Universal agreement on these interventions suggests readiness among stakeholders to address gender and inclusion gaps in school WASH program.

Alignment of Delphi technique findings with UNICEF WASH Framework

The findings are also consistent with UNICEF's systems strengthening framework, which emphasizes governance, financing, capacity building, and monitoring as pillars of sustainable WASH service delivery (UNICEF, 2024). Strong consensus on increased budgetary allocation and stakeholder engagement supports UNICEF's assertion that effective WASH program requires robust institutional and financial systems.

The prioritization of hygiene promotion aligns with UNICEF's Three-Star Approach, which promotes improvements in behavior, infrastructure, and school environment (UNICEF, 2023). High consensus on WASH education materials and school-based activities indicates that these interventions are both feasible and acceptable locally.

Furthermore, UNICEF's focus on equity and inclusion is strongly reflected in the prioritization of interventions for learners with disabilities and menstrual hygiene management (UNICEF, 2025). Near-universal agreement suggests that these considerations are central to expert perspectives and are viewed as essential components of WASH programming.

The findings also support the WASH FIT framework, which emphasizes governance, financing, stakeholder involvement, and monitoring. Strong expert consensus on these elements provides empirical support for applying WASH FIT in school settings.

5.7.4 Comparison with Previous Delphi Studies in School Health Systems

The findings are consistent with previous Delphi studies, which identify stakeholder engagement, policy integration, and capacity building as critical to effective school health program implementation. For instance, Cygan *et al.* (2024) emphasizes the importance of multi-stakeholder involvement, a finding mirrored by the strong consensus on collaboration in this study.

Similarly, Chu *et al.* (2026) highlights the role of organizational capacity and communication in improving school health outcomes. The strong agreement on coordination mechanisms in this study reinforces the importance of a whole-school, multi-sectoral approach.

A key feature of Delphi studies is the identification of both consensus and divergence. While most interventions achieved high agreement, outsourcing maintenance of WASH facilities showed lower consensus (74%, mean 3.9, SD 1.0), indicating variability in expert opinion. This aligns with Delphi literature, where lower agreement reflects context dependence or feasibility concerns (Niederberger et *al.* 2024). This finding highlights the need to consider contextual realities in policy implementation.

Additionally, previous Delphi studies emphasize combining structural (infrastructure) and behavioral interventions (Oxley *et al.* 2024). The findings of this study support this balanced approach, as both categories of interventions were highly prioritized.

5.8 CONCLUSIONS

Strengthening school WASH in Kenya cannot be achieved through infrastructure alone. The expert consensus from Uasin Gishu County points to a comprehensive implementation agenda: multi-sectoral governance with clearly defined roles; dedicated, ring-fenced financing for infrastructure, operation and maintenance, and MHM; reliable and safe water through school-level supply and testing; modern, disability-inclusive sanitation; reinforced health education and school-community engagement; and robust supervision with transparent follow-up and incentives for excellence. Operationalizing these priorities within existing policy frameworks provides a feasible pathway to improve learner health, reduce absenteeism particularly for girls and advance educational equity. Making these shifts routine rather than episodic requires political will, predictable finance, and disciplined accountability mechanisms that link standards to practice in every school.

5.9 RECOMMENDATIONS

Based on the expert consensus and the interpretation of findings, several actionable recommendations are proposed to strengthen the implementation and sustainability of school WASH programs in Kenya. These recommendations align national policy intentions and global standards for equitable school health systems.

The first recommendation is to strengthen multi-sectoral governance and coordination. The Ministry of Education, Ministry of Health, county governments, water departments, public works, CHEWs, reproductive health nurses, private schools, and development partners should adopt a more structured and harmonized coordination mechanism. Clear role delineation and reporting pathways are essential to ensure accountability and seamless implementation across levels.

Secondly, the government should establish dedicated budget lines for WASH schools to address chronic underfunding. School WASH should receive a dedicated budget line at national, county, and school levels. This funding should specifically cover infrastructure development, routine operation and maintenance, hygiene supplies, and menstrual health management commodities to ensure continuity and program sustainability.

Thirdly, schools should prioritize sustainable water solutions, including drilling boreholes equipped with solar pumping systems and routine water quality testing. These measures will ensure consistent access to safe drinking and hand-washing water, reducing disease risk and supporting daily school operations.

The ministry of Education should strengthen WASH Education, health promotion, and community engagement these can be achieved through WASH content being expanded in the curriculum, supporting active school health clubs, commemorating school WASH days, and outreach activities. Engaging parents and communities, these will reinforce hygiene behaviors both at school and at home.

County governments should reinforce monitoring, inspection, and accountability mechanisms of School WASH by increasing the number of Quality Assurance and Standards Officers and Public Health Officers dedicated to WASH. Establishing minimum inspection frequencies and standard monitoring tools will improve compliance and timely feedback. Follow-up on WASH-related expenditures should be mandatory for transparency and accountability.

Lastly, it is recommended that Ministry of Education should promote recognition of WASH high-performing schools. Instituting awards for schools demonstrating excellence in WASH implementation can motivate improved performance, foster innovation, and promote peer learning across institutions. Such recognition can serve as an incentive to maintain high WASH standards.

5.10 DECLARATIONS

Ethical approval and consent to participate

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki for research involving human participants. Ethical clearance was obtained from the

Institutional Research Ethics Committee (IREC) of the Durban University of Technology, South Africa, and from the Ethical Review Committee of the University of Eastern Africa, Baraton, Kenya. Additional authorization to conduct the study in Kenya was granted by the Ministry of Education in Uasin Gishu County and the National Commission for Science, Technology and Innovation (NACOSTI). IREC Ethical Clearance number was (IREC 113/23)

Information sheet and letters of consent were shared with individuals invited for participation in the Delphi study and the entire study. In these letters participants were informed that their participation was voluntary and they would withdraw at any stage of the study. All experts were over 18 years of age. Survey responses were anonymous as no personal identifiers or information was required from participating individuals. Participants were then asked to sign consent forms if they agreed to participate in the study.

Consent for publication

The research paper does not contain any individual, personal data in any form. No consent for publication needed. Consent for publication was therefore not applicable.

Availability of data and materials

All data generated or analyzed during this study are included in this published article and or are part of supplementary information files. The data will also be available DUT Library Repository.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

GCS conceptualized the study and prepared the draft proposal under the supervision of GGM and MAGN.

GCS and GGM contributed to developing the background and designing the study.

GCS prepared the manuscript, while GGM and MAGN critically reviewed it.

GCS accessed library resources and conducted data analysis.

All authors (GCS, GGM, MAGN) reviewed and approved the final manuscript.

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Connecting text

Chapter 5 (Phase 2) provided the empirical foundation for intervention development. Using a two-round Delphi consensus technique, the chapter systematically elicited, refined, and prioritized expert perspectives on who should be involved, what should be included, and how school WASH programs should be implemented in primary schools in Uasin Gishu County, Kenya. The findings from Delphi Round 1 generated rich qualitative insights on governance gaps, infrastructure needs, and menstrual health management, inclusivity, financing, and coordination mechanisms. Delphi Round 2 quantitatively validated these insights, demonstrating strong expert consensus on priority components required for effective, equitable, and sustainable school WASH implementation. Thus, Chapter 5 identified evidence-based needs, gaps, and agreed-upon solutions from key stakeholders and established the content and direction for intervention design. It was presented in the form of a manuscript awaiting submission for publication.

Building directly on these validated findings, Chapter 6 (Phase 2) translated the Delphi evidence into actionable interventions. The chapter operationalized the expert consensus by developing a structured three-pronged WASH intervention strategy, ensuring alignment between empirical findings and practical application.

CHAPTER 6: DEVELOPED WASH INTERVENTIONS

6.1. DEVELOPED THREE-PRONGED WASH INTERVENTION STRATEGY FOR PANDEMIC PREPAREDNESS AND INFECTION CONTROL FOR PRIMARY SCHOOLS IN KENYA

This chapter presented three WASH interventions for primary schools. A three-pronged WASH intervention strategy has been used to present the interventions because the researcher wished to provide an intervention at all levels: one that contributed directly to the well-being of the learner, another intervention to guide in the delivery of WASH services, and the last intervention to the decision makers who can bring about changes in the policy, structures and system of WASH in schools in Kenya. The importance of a three-pronged intervention strategy for WASH in schools lies in its ability to create a structured, holistic, and sustainable approach to improving water, sanitation, and hygiene systems.

Intervention 1, an informational guide to menstrual health, addresses what should be included in the WASH program for primary schools. Intervention 2, the WASH pyramid framework, identifies who should be involved and what should be done. Intervention 3, a policy brief, explains how to implement the WASH program in Uasin Gishu County, Kenya.

6.2 THEORETICAL JUSTIFICATION OF THE THREE-PRONGED WASH INTERVENTION STRATEGY

The three-pronged WASH intervention strategy is theoretically grounded in established frameworks from public health, health promotion, systems thinking, disaster risk reduction, and implementation science, all of which emphasize that sustainable health and education outcomes are achieved through multi-level, integrated interventions rather than isolated actions (McLeroy *et al.*1988; WHO, 2007; UNICEF & WHO, 2023).

The overall structure of the strategy is informed by the Socio-Ecological Model (SEM), which hypothesizes that health behaviors are shaped by interactions across multiple levels, including individual, organizational, community, and policy environments (Bronfenbrenner, 1979; McLeroy *et al.*, 1988). The SEM is mainly useful for designing interventions aimed at promoting healthier behaviors, as SEM particularly recognizes the need to address not only individual factors but also community and policy-

level influences (Kilanowski, 2017). The three-pronged strategy adopted the SEM in designing school WASH interventions to include multi-level spheres of interaction including individual, organizational, and policy. The learner-centered intervention targets individual-level determinants such as knowledge, attitudes, and self-efficacy; the operational intervention strengthens school-level systems and institutional capacity; and the strategic intervention addresses policy, governance, and financing mechanisms. This alignment reflects evidence that behavior change among learners cannot be sustained without enabling institutional and policy contexts (WHO, 2007; UNICEF, 2019).

The learner-centered intervention, operationalized through the informational guide to menstrual health, is further grounded in the Health Belief Model (HBM), which explains health behavior as a function of perceived susceptibility, severity, benefits, barriers, and self-efficacy (Rosenstock, 1974). By increasing menstrual health knowledge, challenging myths, and normalizing hygienic practices, the intervention enhances girls' capacity to manage menstruation safely and with dignity. Empirical evidence demonstrates that inadequate menstrual health knowledge and lack of supportive information contribute to absenteeism, stigma, and psychosocial distress among schoolgirls, underscoring the scientific relevance of education-based interventions (Hennegan & Montgomery, 2016; UNICEF & WHO, 2024).

The operational intervention, represented by the WASH Pyramid Framework, is grounded in systems theory, health systems strengthening, and disaster risk management (DRM). Schools operate as complex systems in which governance, infrastructure, preparedness, response, and recovery are interdependent (WHO, 2007). The pyramid structure reflects this interdependence by positioning governance and core WASH infrastructure as foundational prerequisites for effective preparedness, outbreak response, and post-crisis recovery. The framework aligns with the DRM cycle and the Sendai Framework for Disaster Risk Reduction (2015–2030), which emphasizes risk reduction, preparedness, coordinated response, and "building back better" as essential for resilience (Aitsi-Selmi *et al.* 2015; WHO, 2023).

The strategic intervention, presented as a policy brief, is theoretically informed by implementation science and knowledge translation theory, which highlights the persistent gap between research evidence and policy action (WHO, 2014). Translating research findings into concise, context-specific policy

guidance enhances uptake by decision-makers, facilitates integration into planning and budgeting processes, and promotes institutionalization of WASH interventions beyond short-term projects (UNICEF, 2019; World Bank, 2023).

Collectively, the three-pronged WASH intervention strategy integrates behavioral theory, systems and resilience thinking, and policy implementation frameworks to address proximal, intermediate, and distal determinants of school WASH outcomes. This integrated, multi-level approach is consistent with global guidance on WASH in schools and reflects contemporary public health consensus that sustainable improvements in school health require coordinated action at learner, institutional, and policy levels (UNICEF & WHO, 2023).

6.3 RATIONALE FOR THREE-PRONGED WASH INTERVENTION STRATEGY FOR PANDEMIC PREPAREDNESS AND INFECTION CONTROL FOR PRIMARY SCHOOLS IN KENYA

The table 15 demonstrates how findings from the Delphi technique were systematically translated into a three-pronged WASH intervention strategy. Through iterative rounds of expert consultation, the Delphi process generated consensus on critical gaps and priorities in school WASH implementation, spanning learner needs, operational systems, and policy environments. These expert-identified domains provided a structured foundation for intervention development.

At the **learner level**, Delphi participants consistently highlighted challenges related to menstrual health misinformation, stigma, and absenteeism among girls, alongside inadequate gender- and disability-inclusive hygiene education. These gaps directly informed **Prong 1**, resulting in the development of the *Informational Guide to Menstrual Health in Primary Schools*. This **learner-centred intervention** responds to expert consensus by addressing knowledge deficits, promoting dignity, and supporting equitable participation in education.

At the **school operational level**, experts reached strong agreement on weaknesses in coordination, monitoring, water quality management, and preparedness for infectious disease outbreaks. The absence of a structured operational framework was identified as a major barrier to sustainable WASH delivery. These findings informed **Prong 2**, leading to the design of the *WASH Pyramid Framework*, which

provides a tiered operational model integrating routine WASH services, infection prevention, and pandemic preparedness.

At the **strategic and policy level**, Delphi findings underscored fragmented governance, unclear institutional roles, weak policy enforcement, and insufficient financing for school WASH programs. To address these systemic constraints, **Prong 3** was developed in the form of a *Policy Brief on Building Resilient School Health Systems through WASH*. This intervention translates empirical evidence and expert consensus into actionable policy and financing recommendations aimed at institutionalizing WASH within national and county frameworks.

Table 15: Alignment of Delphi Technique findings with the three pronged WASH intervention strategy

Delphi Technique Domain	Key Delphi Findings / Expert Consensus	Identified Gap or Priority	Corresponding WASH Intervention Prong	Resulting Intervention Output
Learner health and wellbeing	Experts emphasized persistent menstrual health misinformation, stigma, and absenteeism among girls; lack of age appropriate and inclusive menstrual hygiene education	Inadequate learner centred menstrual health education and poor MHM support systems in schools	Prong 1: Learner centred intervention	Informational Guide to Menstrual Health in Primary Schools – provides structured, culturally sensitive, and age appropriate menstrual health information for learners, teachers, and parents
Gender equity and inclusion	Delphi panel highlighted limited support for girls during menstruation and inadequate provision for learners with disabilities	Inequitable access to WASH information and facilities, especially for girls and learners with special needs	Prong 1: Learner centred intervention	Menstrual health guide incorporating gender sensitivity, stigma reduction, and disability inclusive messaging

School level WASH operations	Experts reported weak coordination of WASH activities, inconsistent water quality monitoring, poor operation and maintenance of facilities	Absence of a structured operational framework guiding routine and emergency WASH practices	Prong 2: Operational intervention	WASH Pyramid Framework for Pandemic Preparedness and Infection Control – establishes a tiered operational system for routine WASH delivery and outbreak response
Infection prevention and preparedness	Delphi consensus noted insufficient preparedness for infectious disease outbreaks (e.g., COVID 19), despite existing WASH infrastructure	Lack of integration between WASH practices and infection prevention and control (IPC)	Prong 2: Operational intervention	WASH Pyramid Framework integrating WASH, IPC, and pandemic preparedness across school systems
Monitoring and evaluation	Experts identified limited monitoring, weak feedback mechanisms, and absence of performance tracking for school WASH programs	Weak accountability and sustainability of WASH interventions	Prong 2: Operational intervention	Operational indicators and monitoring elements embedded within the WASH Pyramid Framework
Governance and coordination	Delphi panel stressed unclear roles between national, county, and school level stakeholders	Fragmented governance and implementation responsibilities	Prong 3: Strategic intervention	Policy Brief on Building Resilient School Health Systems through WASH – clarifies roles and promotes intersectoral coordination
Financing and sustainability	Experts consistently highlighted inadequate and unreliable funding for WASH infrastructure and maintenance	Lack of sustainable financing mechanisms for school WASH	Prong 3: Strategic intervention	Policy brief advocating for ring fenced WASH financing and integration into education and health budgets
Policy integration	Delphi findings showed weak enforcement and limited alignment of existing school	Poor policy translation into actionable school level implementation	Prong 3: Strategic intervention	Policy brief translating evidence and Delphi consensus into actionable

	health and WASH policies			policy recommendations

CONCEPTUAL MODEL RELATIONSHIP WITH DEVELOPED INTERVENTIONS

The Logic Model of input, activities, output and outcome provided the foundational structure upon which Chapter 6 is organized.

Inputs

Chapter 6 explicitly draws on inputs identified in earlier phases, including: Existing school infrastructure and resources (Chapter 4), human and institutional capacity (teachers, school management, county officials), policy and governance mechanisms identified through document analysis and expert knowledge and stakeholder experience (Chapter 5). These inputs informed the feasibility and contextual appropriateness of the interventions developed in Chapter 6.

Activities and Outputs

The interventions presented in Chapter 6 constitute the core activities and outputs of the study:

- Development of a learner-centered **Informational Guide to Menstrual Health**,
- Design of the **WASH Pyramid Framework** to guide implementation and system strengthening,
- Preparation of a **policy brief** to support governance, coordination, and sustainability.

Each intervention is intentionally positioned as a direct output of the logic model, ensuring that activities are clearly linked to intended outcomes rather than existing as isolated programmatic tools.

Intended Outcomes and Impact

Chapter 6 explicitly articulates short- and medium-term outcomes aligned with the theoretical framework, including: Improved knowledge and practices among learners and teachers, strengthened

operational WASH systems in schools and enhanced preparedness for infectious disease prevention and response.

6.4 INTERVENTION 1: INFORMATIONAL GUIDE TO MENSTRUAL HEALTH IN PRIMARY SCHOOLS

OVERVIEW OF THE INFORMATIONAL GUIDE TO MENSTRUAL HEALTH

The Informational Guide to Menstrual Health in Primary Schools is a practical and inclusive resource aimed at helping adolescent girls, including those with disabilities, understand and manage menstruation confidently and hygienically. The information guide was developed as a priority since it emerged as an area of greater need at the school level. The informational guide to menstrual health highlights the physical and emotional changes during puberty, explains the menstrual cycle, and introduces various menstrual products with guidance on their use and disposal. The guide highlights hygiene, nutrition, and self-care during menstruation, urging girls to seek medical help when needed. It also dispels harmful myths and taboos surrounding menstruation, hence promoting open discussion and dignity. Special attention ought to be given to the unique challenges faced by girls with disabilities, advocating for accessible facilities, caregiver support, and inclusive education.

INFORMATIONAL GUIDE TO MENSTRUAL HEALTH IN PRIMARY SCHOOLS

Leave no girl behind













6.4.1 INTRODUCTION

Significant gaps remain in menstrual hygiene management worldwide, especially in low- and middle-income countries. Limited access to products, inadequate education, poor information, insufficient WASH facilities, and unsafe disposal options negatively impact the health and well-being of schoolgirls (UNICEF & WHO 2024; Schmitt *et al.* 2024). These challenges are often compounded by harmful cultural norms, stigma, and misinformation. The primary objective of MHM is to ensure that girls and women can manage menstruation safely and with dignity by providing access to hygienic products, sufficient water and sanitation facilities, and thorough education (Betsu *et al.* 2024). Beyond hygiene, MHM is a matter of gender equity and human rights, closely linked to educational participation and aligned with Sustainable Development Goal 6, which emphasizes equitable access to resources essential for menstrual health.

Research indicates that effective menstrual hygiene management (MHM) in schools can lead to lower absenteeism, higher rates of school retention, improved health, and an overall better quality of life for girls (Ishimwe Bazakare *et al*. 2025; Girmay *et al*. 2023). Access to accurate information on sexual and reproductive health alongside female-friendly facilities, affordable, high-quality menstrual products, remains critical to achieving adequate MHM (World Bank Group 2022). Despite some advancement, worldwide improvement is still constrained: just 39% of schools offer menstrual health education and less than a third have waste bins for menstrual products in girls' restrooms (United Nations Children's Fund and World Health Organization 2024). Adolescents in many settings, including Kenya, Nigeria, and Uganda, continue to enter puberty with little or inaccurate knowledge due to persistent myths, cultural restrictions, and misinformation (Castro & Czura 2025; Msovela *et al*. 2025). Awareness of menstruation before menarche is therefore recognized as a key indicator for advancing menstrual health, human dignity, and gender equality at both national and global levels (Hennegan *et al.* 2022).

Menstrual health represents an important aspect of both disability and human rights. In accordance with the United Nations Convention on the Rights of Persons with Disabilities (CRPD), member states are

obligated to provide equal access to high-quality, affordable healthcare services, which encompass sexual and reproductive health care (United Nations, 2006). Girls with disabilities face a disproportionate burden due to environmental barriers, stigma related to disability, restrictive practices during menstruation, and reliance on caregivers, which together limit access to information, products, and services (Basnet, Khatri, and Lamichhane 2024). They are less likely to receive appropriate menstrual education and require inclusive WASH facilities, tailored information, social support, and assistance with product use and disposal (Wilbur, Poilapa, and Morrison 2022). Persistent myths such as assumptions that girls with disabilities do not menstruate or are impure further restrict access to education and services, highlighting the urgent need for inclusive, myth-dispelling interventions (Wilbur *et al*. 2021). Despite these needs, evidence and interventions addressing MHM among people with disabilities and their caregivers remain limited (Wilbur *et al*. 2019).

In Kenya, MHM is recognized as a core component of WASH under the Kenya School Health Program, and the country has demonstrated strong policy commitment through the development of the Menstrual Hygiene Management Strategy 2019–2024 (Ministry of Education, Ministry of Health, and Ministry of Water, Sanitation and Irrigation 2024). Nevertheless, significant implementation challenges persist. Despite clear policy guidance on roles and budgeting, school WASH and by extension MHM remains underfunded, partly due to devolved governance structures in which many counties lack explicit WASH targets in their integrated development plans (World Bank Group 2022; Ministry of Education, Ministry of Health, and Ministry of Water, Sanitation and Irrigation 2024). Consequently, available funds often prioritize infrastructure construction, with limited allocation for awareness creation, education, and ongoing support for MHM.

Interventions to address menstrual health generally fall into two broad categories: menstrual education and menstrual supply provision. Educational interventions focus on puberty education, reproductive health, and training on the use of menstrual products, while supply-focused interventions involve providing menstrual materials and improving water and sanitation infrastructure (Betsu *et al*. 2024). Knowledge-based interventions and supportive tools help adolescents manage menstruation safely and

confidently. These measures should address harmful social norms and provide resources tailored for girls with disabilities (Phillips-Howard 2022).

6.4.2 THE INFORMATIONAL GUIDE TO MENSTRUAL HEALTH

This guide is designed to provide information on menstrual health to a school-going adolescent girl expecting to get her first period when she is around 8-12 years of age. Menarche, the first menstrual period, signals puberty and introduces new menstrual health needs.

The development of this guide is an output of this thesis a case study research project evaluating WASH interventions in schools in Uasin Gishu County, Kenya. The case study was conducted to propose an intervention to support WASH programs in schools.

The menstrual guide is a knowledge-oriented intervention with an aim of creating awareness on Menstrual Health Management to adolescent girls and, more so, to girls affected with disability. The menstrual guide will be essential to the adolescent girl because many adolescent girls in schools lack information about menstruation before menarche due to sociocultural taboos, shame, and misconceptions around menstruation, which make adults around them, including parents and teachers, uncomfortable discussing sexuality, reproductive health, and menstruation. Sociocultural taboos, shame, and misconceptions about menstruation hinder the spread of accurate, respectful menstrual health information. The issues in menstrual stigma result in the development of fear about menstruation, embarrassment, and lack of preparedness to manage menstruation, contributing to long-lasting negative effects on girls' confidence and well-being (Chandra-Mouli and Patel 2017; Tomlinson *et al.* 2024).

Educating adolescent girls and those with disabilities empowers them to manage menstruation safely, confidently, and improves their sexual and reproductive health. The content of this menstrual guide will include information through questions and answers on puberty, menstruation, misconceptions, myths, and taboos around menstruation, and how to manage menstruation for all primary school-going girls, including girls living with disabilities and their care takers. The guide will also include information on a supportive school environment to promote the Menstrual Hygiene Management program.

The guide will be presented in Word format for girls who can read and an audio format for girls who cannot read but can hear.

6.4.3 QUESTIONS AND ANSWERS ON MENSTRUATION (FACTS ABOUT FEMALE REPRODUCTIVE MATURITY)


No need to worry

6.4.3.1 PUBERTY AND EXPECTED CHANGES

What is puberty?

Puberty is a process in which an adolescent begins to undergo specific physical and emotional changes as they grow from a child to a reproductively mature adult. Some noticeable changes in girls include an increase in body weight and broadening of the hips; development of breasts; appearance of pubic hair; and the beginning of menstruation.

When does puberty occur?

These changes normally occur between the ages of 8 and 12 years in most girls but may vary from one girl to another.

What are the physical changes that occur during puberty in girls?

During puberty, the girl undergoes many physical changes driven by hormones produced by the body; the changes include breast development, the growth of hair in the armpit, a sharp increase in height, widening of hips, and the appearance of hair around in the genital area, the hair is referred to as pubic hair. Girls experience a small amount of clear or white discharge coming out of the vaginal before their first period, but this does not happen to all girls. Another change that takes place during puberty is having

blood come out of the vagina, which is also known as menstruation or periods. The first menstrual period is also called menarche. Some girls may have acne on the face due to increased oil production, which can block the skin pores.

What emotional changes do girls experience during puberty?

Feeling very sensitive and conscious about oneself

During puberty, the body goes through many changes that can make a person feel uncomfortable and highly sensitive about their physical appearance. It is common to experience irritability, lose temper easily, or even feel depressed. Girls may notice that their bodies develop differently from their friends. For example, breast growth or hip widening can lead to self-consciousness. Being aware of these behavioral changes and discussing them with someone you trust is important.

Feelings of uncertainty

Feeling uncertain about the future is another emotional change that occurs during puberty. At this stage, being neither fully a child nor an adult, people start considering unfamiliar aspects of life, such as career, livelihood, and marriage, and their expectations begin to differ from those of others.

Peer pressure

As one gets to puberty, one wishes to spend more time with friends of the same age, have conversations with them, and do things and behave the way they do. One can be easily influenced by what they see around them, in various forms of communication and entertainment widely consumed by the public, and by the culture presented through them. Sometimes one tries to do things one sees or hears around them, which may make one feel uncomfortable; this is known as peer pressure.

Mood swings

Hormonal fluctuations during puberty can lead to frequent and sometimes pronounced mood swings. Individuals may experience rapid transitions from feelings of confidence and happiness to irritation or sadness within a brief period.

Getting sexual feelings

During puberty, one develops sexual maturity. One becomes curious about sex and feels some sexual attraction during this phase of sexual maturity. During puberty, one might feel sexually excited by everyday things, like watching a romantic scene or reading a romantic story. These feelings are normal, and one should not feel guilty about them. It's important to understand these feelings and, if one has questions, to talk to someone they trust.

6.4.3.2 MENSTRUATION

What is menstruation?

Menstruation is a normal biological process that occurs in girls after puberty, involving the monthly shedding of the uterine lining (endometrium) and resulting in vaginal bleeding. Monthly, the ovaries release a mature egg that travels through the Fallopian tubes to the uterus, where it waits for fertilization. The uterus builds a lining to support a fertilized egg, but if fertilization doesn't happen, this lining is shed as menstrual flow over 3–7 days. The process, known as the menstrual cycle, repeats every 25 to 35 days.

When do most girls get their periods?

The onset of menstruation varies for each individual; however, it generally begins approximately two years after the initial development of breast tissue. This stage typically coincides with the appearance of underarm and pubic hair.

How will I know that my first period is coming?

One can know that they are getting close to receiving their first period when one notices a discharge coming out from the vagina. The discharge may present as thin and mildly adhesive or as thick and string-like, with coloration ranging from clear to white or off-white. Characteristics of the discharge can differ among individuals. Usually, this discharge can be noticed on the underwear from the vagina about 6 months before one gets their first period.

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What is Pre-menstrual Syndrome?

Pre-menstrual syndrome is the emotional, behavioral, and physical symptoms that a girl experiences before her period and disappear after the next menstrual period starts. They are a result of changing hormones in the body. Some of the symptoms include mood changes like irritability and anxiety, physical changes such as bloating and breast tenderness, and behavioral shifts like mood swings or fatigue.

How can one deal with premenstrual syndrome?

One is encouraged to drink lots of water, get plenty of sleep, and exercise daily. It is also important to talk to someone that one is comfortable with for reassurance that all is well. One should not be alarmed by these symptoms; they are expected and will stop before the next period starts.

How can one prepare for one's first period?

When one notices clear to white discharge from the vagina, it is a sign that periods are about to come. This is the right time to talk about changes in your body to someone you are comfortable with, like your parent or guardian, so they can provide more information and support, such as purchasing sanitary products for use during periods. It is safer to start carrying a sanitary pad in the school bag after seeing a discharge. If you find that your menstruation has started while at school and you do not have a pad, ask a teacher or the school nurse for one.

Can menstrual period delay to start flowing?

Periods start when one's body is ready. Periods can delay to up to 2 years after one has experienced the first signs of puberty. Some of the reasons for the delay include being overweight, having stress and hormonal imbalance, and engaging in lots of exercise like athletics and gymnastics.

How much blood does one lose during menstruation?

One does not bleed a lot during their first period, but once the cycle settles, one bleeds about 1 to 5 tablespoons (20-90 ml); a girl usually only loses a few tablespoons of blood for the whole period. The bleeding is not a sudden gush but one will see a reddish-brown stain on the pants or on the bed sheets when they wake up in the morning.

How long does a period last?

Periods usually last 3 - 5 days but can be shorter or last longer in different individuals. It is normal for a girl to have irregular periods at menarche. At menarche, the duration may vary from 2 days to 7 days. Periods may take up to one year for them to become regular.

How often does a period happen?

A girl gets her periods around every 28 days, but others may get their periods every 21 to 35 days. One is said to have a regular cycle if the periods come exactly after the same number of days, and an irregular cycle if the number of days vary. The menstrual cycle is the period from the first day of menstruation to the day before the next period.

6.4.3.3 CARING FOR ONE-SELF DURING MENSTRUATION

What can one use to protect oneself from staining clothes with blood during menstruation?

There are a few products one can use during menstruation to protect their clothes from staining; they are called menstrual products. Some of the menstrual products include disposable sanitary pads, reusable pads/clothes, tampons, and menstrual cups. All are safe and hygienic options for period management. Product choice is personal and depends on local availability. It might be worth experimenting until one finds the product that suits them best. One can use only one method at a time; however, one can switch

between different methods. Table 16 displays images of the available menstrual products. Table 17 presents a summary of menstrual products, how to use them, the duration of time spent with each menstrual product before changing, and the number of menstrual products to use per day.

Table 16: Types of menstrual products

Disposal pad	Reusable cloth	Menstrual cup	Tampon
			

Table 17: Menstrual product types and their usage

	Disposable Sanitary pad	Reusable cloth	Menstrual cup	Tampon
How to use	The pad is worn externally and attached to the underwear using adhesive tape. It absorbs menstrual flow and is discarded after a single use	It is a cotton fabric pad that is sewn and fastened to underwear with snaps, worn externally to absorb menstrual flow. After use, it is washed, dried, aired, and can be reused for about one year.	It is a bell-shaped device inserted into the vagina to collect menstrual flow. It stays in place by forming a seal against the vaginal walls. After use, the collected blood is emptied, and the cup is cleaned and boiled in water for 5–10 minutes. Menstrual cups are reusable for 5–10 years.	It is a small cylindrical product inserted into the vagina to absorb menstrual flow. It expands upon contact with moisture to prevent leakage and is removed using an attached string before being disposed of.
Wearing time	Approximately 3-6 hours	Approximately 3-6 hours	6-12 hours	Maximum 8 hours
Amount needed per day	4-6 pads per day.	5-6 pads	2-3 cups	2-3 tampons per day

What can one do if menstrual blood leaks through one's clothes?

In case of leakage of menstrual blood through one's clothes, one should cover the stains by tying a sweater or jacket around their waist; if one has a spare cloth in the bag, one can change. One can also ask a friend for a sweater if they don't have anything to cover themselves with.

Is menstruation associated with any pain?

Girls commonly experience pain during periods, also referred to as **cramps**; the pain is felt in the lower part of the abdomen, around the pelvic region. It is caused by the womb contracting to push blood and tissue out of the uterus. The pain can be throbbing or cramping. Sometimes, it can be severe enough to interfere with daily activities during menstruation.

During periods, one may have other symptoms, including hip pain, lower back pain, nausea and vomiting, diarrhea or loose stools, headaches, and dizziness or faintness. The abdominal pain can differ each month from one girl to another.

How does one manage menstrual pain?

Menstrual pain can be relieved by simple measures, such as gentle exercise like walking. Regular sleep, drinking plenty of water and a warm heating pad on the belly can help relieve symptoms. If it is necessary, one can take prescribed pain medication.

Is it okay to come to school while having the periods?

Menstruation is a natural part of puberty for girls, and daily activities can continue as normal.

6.4.3.4 HYGIENIC PRACTICES DURING MENSTRUATION

What are the health habits and hygiene during periods?

It is important to practice good menstrual health and hygiene during periods to prevent infections, reduce bad smell, and help one stay comfortable.

Some of the good hygienic practices during periods include:

- Taking a bath twice a day: in the morning and in the evening to avoid bad smell and the risk of infections. During bathing one should clean the genital area by washing outside the vagina and bottom every day.
- Using water only to rinse the vulva; the vagina is a self-cleaning organ.
- Always washing hands with soap after using the toilet, before changing menstrual products and after.

- Always dispose of used menstrual products in a waste bin; never flush them, as they can block toilets.
- Wear breathable cotton underwear, as tight fabrics trap moisture and heat, encouraging germs.
- Drinking a lot of liquids to stay hydrated and prevent reproductive tract infections.

Can bleeding during periods lead to deficiency of blood in the body?

Menstruation in a healthy girl/ woman cannot lead to blood deficiencies such as Iron deficiency anemia. The amount of blood lost during menstruation is very minimal and one does not need to worry.

Is there special nutritional requirement during years of menstruation?

A balanced diet supports a girl's growth and health. While menstruation does not require special nutrition, girls should consume iron-rich foods after puberty to replenish blood lost during periods. Iron sources include green leafy vegetables like kale and spinach, lean red meat, almonds, lentils, and iron-fortified cereals.

Is menstruation a lifetime occurrence?

A girl who has started having her periods will continue having them monthly until she attains 45-55 years of age when the periods stop (this is called menopause). Also, a girl or woman will stop having periods when she is pregnant.

6.4.3.5 HANDLING OF MENSTRUAL PRODUCTS AFTER USE

Where are the disposable sanitary pads disposed of after use?

The right place to dispose of used disposable sanitary pads is in a bin specifically meant for disposing sanitary towels. The sanitary bins are normally placed in the female toilets or a designated point in the school compound.

If sanitary bins are not available in the school, guidance will be provided on where to dispose used pads.

The sanitary towel should be wrapped in a wastepaper before it is put in the sanitary bin and one should remember to wash one's hands. A sanitary pad should not be disposed of in a flush toilet because it will easily clog the drainage system.

6.4.3.6 SEEKING FOR MEDICAL ATTENTION DURING MENSTRUATION

What signs during menstruation should make one seek for medical attention?

One needs to seek for medical attention in case one experiences any of the following signs during menstruation:

- If one is experiencing unexpected changes in their period. Some of the changes include severe lower abdominal pain that interferes with daily activities or denies one a chance to stand or walk.
- If abdominal pain gets worse over time.
- If over-the-counter pain relievers are not helping.
- If periods are accompanied by heavy bleeding or clotting and one has to change the pad every 1 to 2 hours.
- If one stops bleeding for a long time
- If one bleeds between periods or gets periods before the menstrual cycle is complete.

6.4.3.7 MYTHS AND TABOOS AROUND MENSTRUATION

Does using a tampon break the hymen or cause loss of virginity?

Using a tampon does not cause loss of virginity; however, using it can occasionally cause a girl's hymen to stretch or tear. Virginity is defined by having penetrative sexual intercourse, not the state of the hymen.

Can one exercise during their periods?

Exercising during periods can ease period pain and fatigue.

Is someone said to be unclean during menstruation and should not visit holy and public places?

Menstruation is a normal biological process and does not make anyone 'unclean' or unable to take part in activities.

Are PMS symptoms real?

PMS is a real condition; its symptoms include fatigue, headache and mood changes.

Can one get pregnant on their periods?

It is possible to get pregnant while menstruating, especially with irregular menstrual cycle.

Is period blood dirty or unclean?

Menstrual blood is not dirty; it is simply blood mixed with uterine tissue. The vagina naturally cleans itself, so there is no need to wash inside during periods or at any other time. It is healthy to gently wash the vulva (the outer part of the vagina) with clean water. Having your period does not make you unclean

Should one be shameful of and embarrassed during menstruation?

Menstruation is a natural, normal part of life, and there is no reason to feel shame or embarrassment about it, one should see periods as a sign that one's body is undergoing normal processes of development. One can talk to other girls who had their periods to break the stigma.

Can one wash one's hair during their period?

Washing hair is part of self-care which may even make someone feel a bit refreshed. There is no reason why someone should not wash their hair during menstruation.

Is it true that women and girls should avoid certain foods, like sour or cold foods, during menstruation?

Some cultures restrict women and girls from eating certain foods or drinks during menstruation, but there is no scientific basis for avoiding items like dairy or cold beverages. No medical evidence supports dietary restrictions during menstruation, and such limitations may cause nutrient deficiencies and health risks.

Can topics on menstruation be discussed in public places?

Menstruation is natural and should be discussed openly. Cultural discomfort often makes people avoid this topic, but public conversation can help reduce stigma and break taboos.

Is it true that women and girls should not wash their genitals during their period to avoid contaminating water sources or spreading infection?

Bathing regularly is encouraged during menstruation to prevents having a bad smell, to feel fresh, even boost one's mood and prevent infections. Washing helps maintain good hygiene.

Should use menstrual materials, like pads, be hidden or disposed of in a way that avoids discovery due to fear of being cursed or stigmatized?

Used menstrual products like pads and tampons should be disposed in the right places and the re-washable pads should be washed and dried in the sun. The menstrual cup should be washed and boiled in water before reuse. Hiding menstrual materials can lead to unsafe practices. In some cultures, menstrual blood is seen as magically potent or dangerous, capable of causing harm to plants, food, animals, or even people; these beliefs have not been proven to be true.

6.4.3.8 SUPPORTIVE ENVIRONMENT FOR MENSTRUAL HYGIENE MANAGEMENT IN PRIMARY SCHOOLS

The study developed a comprehensive checklist of essential elements necessary for establishing and sustaining an effective MHM program in primary schools. The checklist serves as an assessment and implementation tool, enabling schools, policymakers, and stakeholders to systematically evaluate the presence of critical components and identify gaps requiring intervention. Elements to be included for an effective Menstrual Hygiene Management program in schools are enlisted in a checklist in Table 18.

Table 18: Checklist for MHM program in primary/ elementary schools

School MHM program elements	Present	Absent
Water availability		
Separate toilets for boys and girls		
Menstrual hygiene products for girls		
Adequate toilet facilities and accessible to children with disability		
Menstrual changing rooms accessible to girls with disability		
Private washing places accessible to girls with disability		
Private drying places of menstrual materials accessible to girls with disability.		
Menstrual products for emergencies		
Sanitary disposal bins/ disposal places accessible to girls with disability		

Water and soap in girl's rooms		
Department or teacher designated for MHM		
Talks on MHM to both boys and girls of age		
Inclusion of MHM in the school curriculum		
MHM training for all teachers		
Availability of medications for menstrual pain management in school		
Booklets/ pamphlets on menstrual hygiene management for boys and girls including those with disability		
WASH Club with MHM activities		
Informational program for school, PTA, and Community on menstrual hygiene management		
Commemoration of world menstrual hygiene day in school		
Commemoration of hand washing day in school		
Health professional talk on MHM to school children		
Health professional talk on MHM with care givers of school girls with disability		

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National Health Service (NHS) https://www.nhs.uk/conditions/periods/period-problems/

6.5 INTERVENTION 2: WASH PYRAMID FRAMEWORK FOR STRENGTHENING PANDEMIC PREPAREDNESS AND INFECTION CONTROL IN PRIMARY SCHOOLS IN KENYA

6.5.1 OVERVIEW OF THE WASH PYRAMID FRAMEWORK

This document outlines a pyramid-shaped framework for strengthening pandemic preparedness in Kenyan primary schools using WASH (Water, Sanitation, and Hygiene) systems. The WASH pyramid framework presents a structured approach that starts with governance and core infrastructure and then builds through preparedness, response, and recovery. It emphasizes inclusivity, digital literacy, and coordinated action to help schools prevent, manage, and recover from infectious disease outbreaks.

The WASH Pyramid Framework integrates with both the Disaster Risk Management (DRM) Framework and the Sendai Framework for Disaster Risk Reduction (2015–2030) in its development. The WASH pyramid framework was developed to reflect the structural and hierarchical roles of all stakeholders in implementing WASH interventions in primary schools.

6.5.2 WASH PYRAMID FRAMEWORK FOR PANDEMIC PREPAREDNESS AND INFECTION CONTROL IN PRIMARY SCHOOLS IN KENYA

The WASH pyramid framework for strengthening pandemic preparedness and infection control is a layered, pyramid-shaped framework designed to enhance the resilience of primary schools in Kenya against infectious disease outbreaks. The framework is structured in a way that it reflects both functional hierarchy and systemic interdependence. The visual and structural arrangement allows for a clear representation of the progression from foundational WASH infrastructure to more complex and responsive interventions. Each ascending layer relies on the stability and functionality of the one beneath it, while the broad base of governance ensures that all other components are supported, coordinated, and sustained. The aim of developing the WASH pandemic preparedness and infection control framework is to establish a comprehensive, context-sensitive framework that strengthens primary schools in Kenya's capacity to prevent, respond to, and recover from infectious disease outbreaks. This framework integrates conventional WASH infrastructure with pandemic-specific protocols, digital literacy, and inclusive design principles to promote health equity, safeguard educational continuity, and institutionalize

resilience within school systems. The framework serves as a strategic guide for policymakers, educators, and health practitioners to build resilient, equitable, and health-promoting school environments.

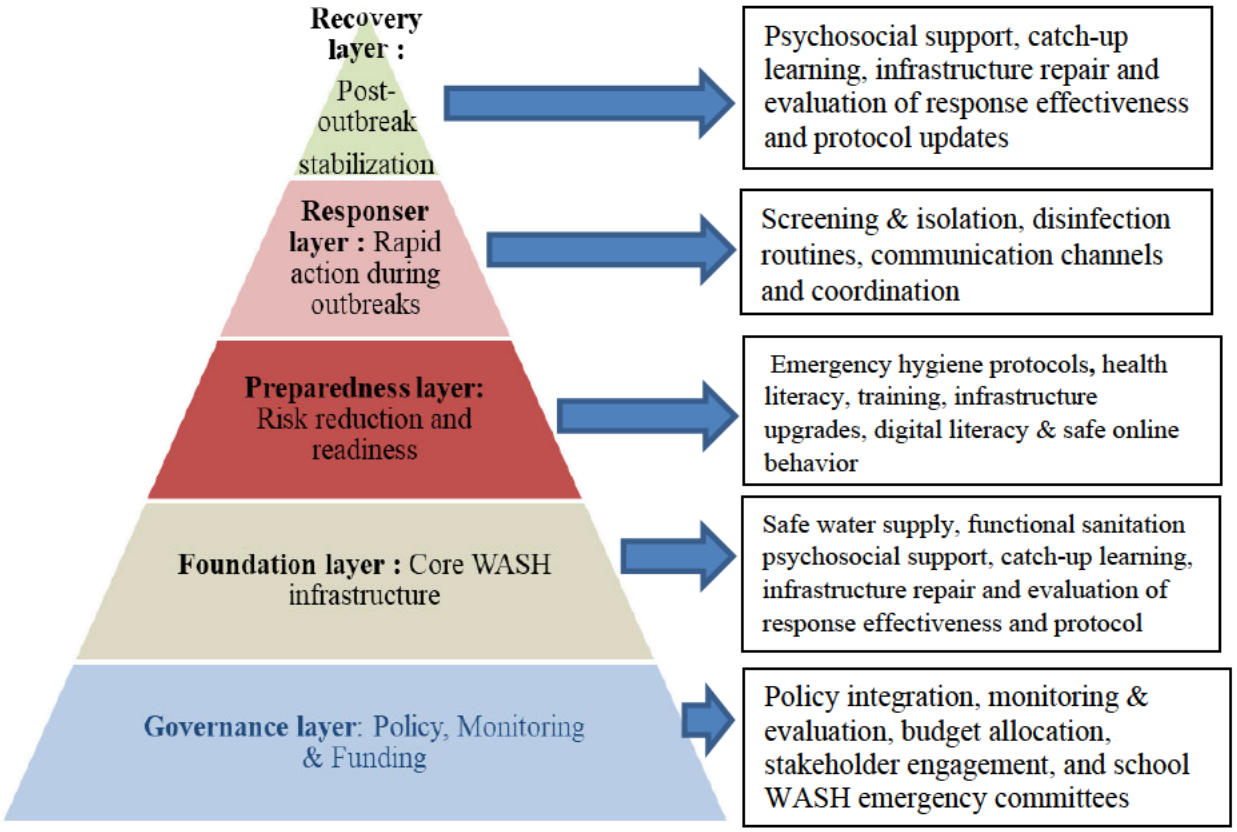


Figure 7:WASH Pandemic Preparedness and Infection Control Pyramid Framework for primary schools

6.5.3 ORGANIZATION OF LAYERS OF THE FRAMEWORK FROM BOTTOM TO TOP OF PYRAMID

As displayed in figure 6, at the foundation of the pyramid lays the **Governance layer** which serves as the structural and operational bedrock of the entire framework. This layer encompasses policy formulation, institutional coordination, resource mobilization, and monitoring and evaluation mechanisms. By positioning governance as the base, the model underscores the critical role of institutional support, political will, and sustainable financing in ensuring the effectiveness and longevity of WASH interventions.

It also reflects the understanding that without robust governance, the upper layers of the model cannot be effectively implemented or sustained.

Immediately above the governance base is the **Core WASH infrastructure layer**, which includes the provision of safe and adequate WASH. This layer makes Inclusivity and equity a core principle, so WASH services reach every learner, including those with disabilities and from marginalized groups. Gender-sensitive approaches to menstrual hygiene management and the design of accessible facilities are emphasized to promote universal access and dignity.

The **Preparedness layer** builds upon this foundation by embedding risk reduction strategies and readiness protocols into the WASH system. This includes the stockpiling of hygiene supplies, integration of pandemic awareness into the curriculum, training of school personnel and community health workers, and infrastructural upgrades such as touch less hand washing stations and improved ventilation systems. Crucially, this layer incorporates Digital literacy and safe online behavior as a strategic component. By equipping learners and educators with digital skills, schools can facilitate remote hygiene education, disseminate health information, and promote safe online engagement particularly during periods of school closure or restricted physical interaction.

The **Response layer** is activated during periods of heightened infection risk. It includes rapid response mechanisms such as health screening, temporary isolation spaces, intensified cleaning and disinfection routines, and real-time communication with parents and health authorities. This layer is designed to be agile and responsive, minimizing transmission within the school environment.

At the apex of the pyramid is the **Recovery layer**, which facilitates the transition back to normalcy following an outbreak. It includes psychosocial support for learners and staffs, catch-up learning programs, repair of damaged infrastructure, and post-crisis evaluations to inform future preparedness.

The pyramid shape structure also reflects the progressive nature of resilience-building, where foundational investments in infrastructure, inclusivity, and governance enable more sophisticated and responsive interventions at higher levels. The inclusion of cross-cutting themes such as digital literacy and equity further enhances the framework's relevance, adaptability, and alignment with contemporary

educational and public health priorities. It also simplifies complex relationships into an intuitive format, making it useful for policy communication, implementation planning, and stakeholder engagement.

6.5.4 ALIGNMENT OF THE WASH PYRAMID FRAMEWORK WITH WASH AND OTHER FRAMEWORKS

The WASH Pyramid Framework advances existing WASH models by integrating fragmented approaches such as WASH FIT, UNICEF WASH frameworks, and socio-ecological models into a hierarchical, system-based structure. Unlike traditional frameworks that focus on isolated components or processes, the WASH Pyramid provides a comprehensive intervention-oriented model that links infrastructure, behavior change, and governance into a progressive system for sustainable school WASH implementation.

The WASH Pyramid Framework is a strategic, context-sensitive model designed to integrate Water, Sanitation, and Hygiene (WASH) systems into the education sector, particularly within schools. Its layered structure supports both the Disaster Risk Management (DRM) Cycle and Sendai Framework priorities. By embedding WASH systems into school governance and planning, the framework not only safeguards health but also fosters resilient, equitable, and sustainable learning environments across Kenya.

Alignment with the Disaster Risk Management (DRM) Framework

The Disaster Risk Management (DRM) Framework is a strategy to reduce the effects of natural and human-made hazards through four key phases: mitigation, preparedness, response, and recovery. These phases are intended to work in a continuous loop, ensuring that communities and institutions are not only able to withstand disasters but also recover and adapt effectively. The WASH Pyramid Framework aligns with each of these phases of DRM cycle through its layered design as elaborated below:

Mitigation phase

In the mitigation phase, actions are taken to reduce the impact of disasters before they occur. The actions include land use planning, enforcing building codes, and protecting the environment. The base layer of the WASH Pyramid Governance and Core Infrastructure supports mitigation by ensuring that safe

WASH systems are established in schools before any crisis arises. It also strengthens institutional capacity and aligns policies to support long-term risk reduction.

Preparedness phase

Preparedness is about planning and training for disaster response. The WASH Pyramid's Preparedness Layer provides schools with training, digital literacy, and inclusive planning. It promotes community engagement and the development of early warning systems to ensure schools are ready to act before an outbreak or disaster occurs.

Response phase

The response phase entails immediate actions taken during and after a disaster intended to save lives and minimize damage. Within the WASH Pyramid, the Response Layer enables the rapid deployment of hygiene protocols, isolation measures, and health communication strategies. It ensures the continuity of education and provides protection for vulnerable populations during emergencies.

Recovery phase

Recovery is the long-term process of rebuilding and rehabilitation following a disaster. The Recovery Layer of the WASH Pyramid facilitates the reconstruction of WASH systems with enhanced resilience. It also integrates lessons learned from past events into future planning and infrastructure upgrades, ensuring that schools emerge stronger and better prepared.

Alignment with the Sendai Framework for Disaster Risk Reduction (2015–2030)

The Sendai Framework, established by UN member nations, is a worldwide strategy aimed at minimizing disaster risk. Its four main priority areas are all incorporated into the WASH Pyramid Framework.

Priority 1: Understanding disaster risk

The WASH Pyramid Framework begins with risk-informed governance and infrastructure planning. It incorporates vulnerability assessments, particularly for children, marginalized groups, and schools located in high-risk areas. The framework promotes the collection and analysis of data to inform decision-making and improve disaster risk understanding.

Priority 2: Strengthening disaster risk governance

Governance forms the foundation of the WASH Pyramid. It ensures coordination among the education, health, and water sectors. The framework encourages multi-stakeholder collaboration and policy coherence, institutionalizing WASH standards and pandemic protocols within school systems to enhance disaster risk governance.

Priority 3: Investing in disaster risk reduction for resilience

The WASH Pyramid advocates for both public and private investment in WASH infrastructure and digital tools. It promotes inclusive design to ensure accessibility for all learners, including those with disabilities. By embedding health promotion into school environments, the framework builds long-term resilience against future disasters.

Priority 4: Enhancing disaster preparedness and building back better

The upper layers of the WASH Pyramid preparedness, response, and recovery enable schools to act swiftly during crises and rebuild stronger afterward. The framework supports the integration of disaster risk reduction into education planning, ensuring that recovery efforts lead to improvements beyond pre-disaster conditions. It also emphasizes the importance of maintaining continuity in learning and providing psychosocial support during and after emergencies.

6.5.5 WASH PYRAMID FRAMEWORK VALIDATION PROCESS

The WASH Pyramid Framework was validated through a rigorous, multi-method process combining Delphi consensus, expert review, and theoretical alignment with established global frameworks as illustrated in Table 19. This process ensured that the framework is empirically grounded, statistically

supported, contextually relevant, and aligned with international best practices, thereby enhancing its credibility as a strategic model for strengthening WASH implementation in schools.

6.5.5.1 Integrated Validation Model (Synthesis) for WASH pyramid framework

The primary mechanism for validation was the Delphi technique, which provided a systematic approach for generating and refining the framework components. During Delphi Round 1, experts from the education, health, water, and community sectors provided open-ended responses on the critical elements required for effective school WASH implementation. This stage enabled the identification of key components such as governance systems, infrastructure requirements, financing mechanisms, behavior change strategies, and inclusion considerations. By grounding the framework in diverse stakeholder perspectives, this phase established its content validity, ensuring that the framework reflects real-world implementation needs.

The validation process was further strengthened in Delphi Round 2 through structured quantitative assessment. Experts rated the identified components using Likert-scale measures, and statistical indices including mean scores, standard deviations, and levels of agreement were computed. The consistently high agreement across most components confirmed their relevance and importance, thereby establishing construct validity. Core elements such as multi-sectoral governance, sustainable financing, inclusive infrastructure, and menstrual health management achieved particularly strong consensus. At the same time, areas of lower agreement, such as outsourcing services, provided valuable insights into context-specific feasibility concerns, further refining the framework.

Beyond statistical validation, the framework underwent expert review and feasibility assessment, during which participants expressed broad support for its structure and applicability. Experts acknowledged the framework as a practical model for guiding WASH implementation in schools but emphasized the need for enabling conditions such as adequate funding, policy alignment, stakeholder coordination, and inclusive design. These reflections contributed to face and practical validity, demonstrating that the framework is both credible and implementable in practice.

To enhance theoretical robustness, the WASH Pyramid Framework was aligned with globally recognized models, including the Disaster Risk Management (DRM) Framework and the Sendai

Framework for Disaster Risk Reduction. The framework's layered structure corresponds with the DRM cycle phases of mitigation, preparedness, response, and recovery. For example, its foundational layer governance and core infrastructure supports the mitigation phase by ensuring that essential WASH systems are established before crises occur. This alignment provides theoretical validity, situating the framework within internationally accepted approaches to resilience and risk reduction.

The validation process also incorporated contextual adaptation, ensuring relevance to the Kenyan education and public health system. Experts identified gaps in policy implementation, particularly at county and sub-county levels, and emphasized the need to integrate WASH into local governance and budgeting processes. This ensured that the framework reflects local institutional realities, thereby enhancing its ecological validity and applicability.

Finally, validation was reinforced through assessment of stakeholder acceptability and implementation readiness. The broad endorsement of the framework by experts across sectors indicates that it is both acceptable and feasible for adoption. The emphasis on inclusive participation, multi-sectoral collaboration, and community engagement further supports its potential for sustained implementation.

The validation of the WASH Pyramid Framework was summarized in table 19.

Table 19: Validation of the WASH pyramid framework

Validation Type	Method Used	Evidence from Thesis
Content validity	Delphi Round 1	Expert-generated components
Construct validity	Delphi Round 2 statistics	High consensus (mean, SD, % agreement)
Face/practical validity	Expert feedback	Feasibility and acceptance
Theoretical validity	Framework alignment	DRM and Sendai alignment
Contextual validity	Local policy analysis	Kenya-specific adaptation

6.5.6 ASSUMPTIONS DERIVED FROM WASH PYRAMID FRAMEWORK

The assumptions of the WASH pyramid framework for pandemic preparedness and infection control in primary schools were derived from the design, structure, and implementation logic of the framework. These assumptions are inferred from the way the framework is structured and the expectations it sets for successful implementation. If the assumptions are not addressed, the effectiveness of the pyramid framework could be compromised.

1. Schools have basic WASH infrastructure
    - Assumes that schools already have or can feasibly install water sources, toilets, and hand washing stations.
2. Government and stakeholders are willing to collaborate
    - Assumes active participation from county governments, Community Health Workers (CHEWs), school boards, and parents in planning and implementation.
3. Policy integration is possible at county level
    - Assumes that WASH pandemic preparedness can be embedded into County Integrated Development Plans (CIDPs) and supported by local governance structures.
4. Funding can be mobilized for WASH emergencies
    - Assumes availability or accessibility of emergency funds for infrastructure upgrades, supplies, and training.
5. Digital tools are accessible and usable
    - Assumes schools and communities have access to mobile phones, radios, or apps for hygiene promotion and monitoring.
6. Teachers and health workers can be trained
    - Assumes capacity and willingness to train educators and health personnel in outbreak response and hygiene education.
7. Children can learn and practice hygiene behaviors

- Assumes that hygiene education will be effective in changing behavior among pupils, including those with special needs.

8. Outbreaks can be managed within school settings
    - Assumes that schools can implement screening, isolation, and disinfection protocols effectively during outbreaks.
9. Infrastructure can be adapted for pandemic needs
    - Assumes feasibility of installing touch less taps, improving ventilation, and creating isolation-friendly sanitation facilities.
10. Psychosocial and educational recovery is achievable
    - Assumes that schools can provide mental health support and catch-up learning after outbreaks.
11. Monitoring and evaluation systems will be used
    - Assumes that schools and counties will adopt tools like mobile dashboards to track hygiene compliance and response effectiveness.
12. Inclusivity measures will be prioritized
    - Assumes that schools will address gender and disability needs in WASH planning and implementation.

6.6 INTERVENTION 3: POLICY BRIEF ON BUILDING RESILIENT SCHOOLS HEALTH SYSTEM THROUGH WASH PYRAMID FRAMEWORK IN KENYA.

OVERVIEW OF THE POLICY BRIEF ON BUILDING RESILIENT SCHOOL HEALTH SYSTEMS THROUGH WASH PYRAMID FRAMEWORK IN KENYA

6.6.1 INTRODUCTION

This policy brief outlines the need to strengthen Water, Sanitation, and Hygiene (WASH) systems in Kenyan primary schools to improve pandemic preparedness. It presents an analysis of current challenges, including poor infrastructure, weak emergency response, and fragmented planning, and a proposed solution through a five-layered WASH Pyramid Framework. The brief presents research findings, evaluates existing policies, and offers practical recommendations for integrating WASH into school and county-level systems. The policy brief is presented as an intervention to provide direction to decision-makers in education and health, and to policymakers on how a WASH program can be implemented in primary schools in Kenya.

6.6.2 POLICY BRIEF: STRENGTHENING WASH PANDEMIC PREPAREDNESS IN KENYAN PRIMARY SCHOOLS

TITLE: BUILDING RESILIENT SCHOOL HEALTH SYSTEMS THROUGH WASH PYRAMID FRAMEWORK IN KENYA

6.6.3 EXECUTE SUMMARY

Kenyan primary schools face substantial difficulties in ensuring effective WASH systems, which are critical for pandemic preparedness and infection control. Inadequate WASH infrastructure, limited emergency preparedness, lack of integration of WASH into county-level development plans, and insufficient stakeholder coordination and funding are the major challenges to the implementation of WASH interventions in Kenya. The proposed WASH Pyramid Model offers a five-layered, inclusive, and sustainable framework to pandemic preparedness and response in primary schools in Kenya.

This policy brief advocates adopting and integrating a structured WASH Pyramid framework in primary schools to enhance pandemic preparedness, response, and recovery.

6.6.4 DESCRIPTION OF THE PROBLEM

Kenyan schools lack basic WASH infrastructure, including reliable water sources, functional toilets, and adequate hand washing stations. This shortfall not only undermines daily hygiene practices but also leaves schools ill-equipped to respond to infectious disease outbreaks, thereby increasing children's risk of illness and absenteeism.

The COVID-19 pandemic exposed critical gaps in school health systems, particularly in WASH infrastructure and emergency response. Primary schools, especially in underserved regions, lacked the capacity to prevent and manage infectious disease outbreaks due to the absence of formal emergency preparedness and response mechanisms. Most schools lack structured plans, trained personnel, and sufficient emergency supplies to manage health crises effectively. The lack of designated isolation spaces and clear protocols further delays containment efforts during outbreaks.

WASH is often not prioritized in county-level development plans, resulting in fragmented implementation, inconsistent funding, and limited accountability. Without integration into County Integrated Development Plans (CIDPs), WASH initiatives remain vulnerable to shifting political priorities and budget constraints.

Finally, weak stakeholder coordination and inadequate funding hamper the effectiveness and sustainability of WASH interventions. This leads to duplication of efforts, missed opportunities, and slow progress in building resilient school health systems.

6.6.5 OVERVIEW OF RESEARCH FINDINGS

Research findings have shown that implementation gaps in pandemic preparedness, response, and recovery have persisted, especially in Kenyan primary schools. Some of the gaps identified from the research findings include:

- **Inadequate WASH Infrastructure in Schools**

Many primary schools lack basic WASH facilities, including clean water sources, functional toilets, and hand washing stations. This deficiency undermines both daily hygiene practices and emergency response capabilities during pandemics. Without foundational infrastructure, schools cannot implement the most

basic infection control measures. This gap necessitates urgent investment in infrastructure development, especially in marginalized and rural areas, to ensure all schools meet minimum WASH standards.

- **Limited Emergency Preparedness and Response Mechanisms**

Some schools do not have formal systems or protocols for responding to health emergencies. There is a lack of trained personnel, emergency hygiene supplies, and designated isolation spaces. This reactive approach delays containment efforts and increases the risk of widespread infection during outbreaks.

- **Lack of Integration of WASH in County-Level Development Plans**

WASH in schools is often treated as a peripheral issue and is not systematically included in County Integrated Development Plans (CIDPs). This results in fragmented implementation, inconsistent funding, and limited accountability.

- **Insufficient Stakeholder Coordination and Funding**

Multiple stakeholder government agencies, health workers, school boards, parents, and NGOs is at the core of WASH success. However, stakeholder coordination is often weak, and funding streams are fragmented or inadequate. This leads to duplication of efforts, missed opportunities, and slow progress.

6.6.6 CURRENT POLICIES AND POLICY PROPOSAL

Although Kenya has established a range of policies to guide WASH in schools, these frameworks remain inadequate for effective pandemic preparedness and infection prevention due to gaps in scope, implementation, and adaptability. Existing instruments including the Basic Education Act (2013), the Basic Education Bill (2024), the Kenya School Health Policy (2018), the Kenya WASH in Schools Strategy 2024–2029, the Kenya Menstrual Hygiene Management Policy 2019–2024, the Safety Standards Manual for Schools in Kenya (2008), the Guidelines on Health and Safety Protocols for Reopening of Basic Education Institutions amid the COVID-19 pandemic, and the Kenya Menstrual Hygiene Management Strategy 2024–2029 provide an important foundation but do not sufficiently address the demands of sustained infection control and emergency health response in school settings.

In response to these limitations, the policy brief recommends the adoption and integration of a comprehensive and structured WASH framework for primary schools nationwide to strengthen preparedness, response, and recovery during pandemics and other public health emergencies.

6.6.7 RECOMMENDATIONS ON WASH PYRAMID FRAMEWORK

A multi-layered pyramid framework designed is recommended to strengthen WASH systems in primary schools and improve pandemic preparedness, response, and recovery. Each layer builds upon the previous one, creating a comprehensive and resilient framework.

1. Governance Layer – Cross-cutting base

The governance layer calls for integration into County Integrated Development Plans (CIDPs), establishment of School WASH Emergency Committees, and allocation of emergency budgets. Monitoring and evaluation mechanisms, such as mobile dashboards, are essential for tracking hygiene compliance and guiding decision-making. Governance provides the institutional backbone for all other layers. Without strong leadership, coordination, and funding, WASH interventions risk being unsustainable or ineffective.

2. Foundation Layer – Core WASH Infrastructure

This layer addresses both the physical infrastructure and educational elements of WASH. It encompasses the provision of safe water, operational sanitation facilities, hand washing stations, and comprehensive hygiene education. An emphasis is placed on inclusivity, ensuring that all facilities accommodate children with disabilities and are attuned to gender-specific needs, including menstrual hygiene.

3. **Preparedness Layer – Risk Reduction & Readiness**

This layer introduces pandemic-specific enhancements to the WASH system. It includes stockpiling hygiene supplies (soap, masks, gloves), training teachers and health workers, upgrading infrastructure (touch less taps, improved ventilation), and promoting digital literacy for remote hygiene education and safe online behavior. Preparedness builds resilience and minimizes disruption to learning and health services.

4. Response Layer – rapid action during outbreaks

Response layer activates emergency protocols during a health crisis. It includes daily health screening, temporary isolation spaces, scheduled disinfection routines, and enhanced waste disposal. Communication strategies such as SMS alerts and visual guides help inform parents and students. Coordination with local health facilities, timely and organized response efforts can contain outbreaks and protect students and staff.

5. Recovery Layer – post-outbreak stabilization

Recovery layer supports safe return to school and long-term resilience. It includes psychosocial support for students and staff, catch-up learning to address missed lessons, infrastructure repair, and evaluation of the response to improve future protocols. Recovery is essential for restoring normalcy and strengthening systems for future emergencies and ensures that the impact of the outbreak is addressed holistically

6.6.8 CONCLUSION

The five-layered pyramid model offers a structured and scalable approach to pandemic preparedness in schools. By addressing governance, infrastructure, preparedness, response, and recovery, it ensures that schools are equipped to protect learners and staff during health emergencies while promoting long-term resilience.

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Connecting text

The previous chapter (6) presented the three interventions developed for WASH in primary schools being the output of Delphi technique round 1 and 2, part of Phase 2 of the study. The next chapter is Chapter 7 (Phase 3). It presented short-term outcomes of the interventions developed in Chapter 6 by examining their feasibility, acceptability, and implementation potential. Through a validation workshop with WASH experts who had participated in earlier phases, the chapter assessed whether the interventions were realistic, relevant, and sustainable within the Kenyan school context. This chapter did not generate new interventions; instead, it provided a formative evaluation of the three-pronged strategy by identifying perceived facilitators, barriers, stakeholder roles, and implementation considerations. The feedback obtained served to validate the practical relevance of the interventions and to refine their implementation pathways, thereby strengthening their credibility and policy relevance.

PHASE 3

CHAPTER 7: SHORT-TERM OUTCOME EVALUATION OF THE DEVELOPED THREE-PRONGED WASH INTERVENTION STRATEGY FOR PANDEMIC PREPAREDNESS AND INFECTION CONTROL IN PRIMARY SCHOOLS IN KENYA.

7.0 WORKSHOP FEEDBACK WITH WASH EXPERTS ON DEVELOPED THREE-PRONGED WASH INTERVENTION STRATEGY FOR PANDEMIC PREPAREDNESS AND INFECTION CONTROL IN PRIMARY SCHOOLS IN KENYA.

7.1 OVERVIEW OF THE WORKSHOP

The workshop to propose a WASH intervention in schools took place in Eldoret City, Uasin Gishu County, Kenya, on the 7th of October 2025, at Better Health Restaurant. Short-term outcome evaluation utilizing qualitative methods was conducted through a stakeholder validation workshop. The purpose of this phase was to assess the feasibility and acceptability of the developed three-pronged WASH intervention strategy based on expert consensus, rather than to measure quantitative outcomes or test hypotheses

Out of 20 experts who participated in phase 1 and 2 of the study, 15 experts participated in this phase of study translating to a response rate of 75%, as detailed in Table 20. The lower response rate was attributed to re-deployment of WASH experts to other place considering almost one year period since data collection of phase 2 (phases 1 and 2 of the Delphi technique) of the study.

Table 20: Details of the experts who attended the workshop

Experts categories	Allocated codes	Number
Sub-County Education directors	KII-EDU	3
County officer in-charge of water department	KII-ENG	2
Public health officers	KII-PHO	3
Quality assurance and standards officers	KII-QSO	3
School head teachers	KII-SHT	3
School board of Management	KII-BOM	1
	Total	15

7.2 THREE-PROLONGED WASH INTERVENTION STRATEGY

Three-pronged WASH intervention strategy for pandemic preparedness and infection control in primary schools in Kenya was adopted and presented to the workshop participants. This strategy was used by the researcher because the researcher intended to propose three interventions which were the output of the

research study. The pie chart portrayed as figure 7 represents the three interventions proposed by the researcher.



Figure 8:Three-pronged school WASH intervention strategy

Prong 1: Learner-centered interventions

Learner-centered interventions focus on empowering pupils, especially girls and children with disabilities, to practice safe hygiene and manage health risks effectively. They focus on behavior change, hygiene practices, and student empowerment.

The intervention proposed in prong 1 was an informational guide to menstrual health, to be available to girls and boys, teachers, parents, and community members.

Prong 2: Operational interventions

Operational interventions are defined as activities that aim to strengthen the capacity of school leadership and management to implement and sustain WASH programs. These interventions implement policies, monitor compliance, and provide support.

The intervention that was proposed in this prong 2 was a WASH pyramid framework for pandemic preparedness and infection control in primary schools in Kenya.

Prong 3: Strategic interventions

Strategic interventions are those that aim to strengthen the capacity of government administrators and policymakers to implement and sustain WASH programs. The interventions provide policy guidance, funding, and legislation.

The intervention proposed in this prong 3 was a policy brief titled "Strengthening WASH Pandemic Preparedness in Kenyan Primary Schools."

After presenting the three interventions, the experts and the researcher engaged in a dialogue. The experts provided input on the proposed interventions in response to the questions listed below. Their input was geared towards determining the feasibility and acceptability of the proposed interventions.

- What are your views on the proposed intervention in schools?
- How can this proposed intervention be effectively implemented?
- Who should be involved in the implementation of the proposed intervention (the stakeholders)
- What barriers might impede implementing the intervention in schools?
- What are some of the facilitators to implementation of the proposed intervention in schools?

7.2.1 PRONG 1: LEARNER-CENTERED INTERVENTION - INFORMATIONAL GUIDE TO MENSTRUAL HEALTH IN PRIMARY SCHOOLS

The proposed intervention which is the informational guide to menstrual hygiene in primary schools in Kenya was presented to the experts and it elicited the findings presented. The information guide has been presented in chapter 7 as part of this dissertation.

General Views on the informational guide

The discussion surrounding the proposed informational guide for menstrual health management in schools revealed a strong consensus on its value and relevance. Participants affirmed that the guide would be instrumental not only for learners but also for teachers, who often lack a formal reference point when addressing menstrual health. The guide was seen as a vital tool for promoting hygiene, preventing disease, and dispelling myths surrounding menstruation. One of the first concerns raised was the omission

of water supply in the guide's supportive environment section. Experts stressed that clean, reliable water is essential for menstrual hygiene. In many schools, especially during dry seasons, students are required to carry water from home, which poses a significant barrier to maintaining hygiene. Thus, the inclusion of water supply considerations was deemed essential.

Implementation Strategies

When discussing implementation strategies, participants proposed several practical approaches. Budgeting emerged as a key recommendation, with calls for schools and county governments to allocate specific funds for menstrual hygiene interventions. Awareness creation was also highlighted, suggesting that stakeholders including parents, teachers, and community members should be informed and engaged through scheduled sensitization sessions.

The activation of school health clubs was identified as a promising avenue for disseminating the guide's content. These clubs could serve as platforms for peer education and open dialogue. Moreover, participants stressed the importance of starting menstrual hygiene education at home, involving parents to help dismantle cultural myths and taboos. Advocacy campaigns, supported by community-based organizations and NGOs, were recommended to amplify the message and mobilize resources.

Policy support was another critical factor. Stakeholders advocated for the development of formal policies to guide schools in implementing menstrual hygiene programs. Integration of menstrual hygiene education into the national curriculum was also proposed, to ensure that the topic is addressed systematically and sustainably.

Stakeholders identified

The following stakeholders were identified: parents, teachers, and community members, NGOs, community-based organizations, public officials and curriculum developers.

Barriers to implementation of the informational guide to menstrual health

Despite the enthusiasm for the proposed informational guide to menstrual health, several barriers to implementation were acknowledged. Funding constraints were cited as the most significant challenge, with current government allocations lacking specific provisions for menstrual hygiene. Knowledge gaps among students and educators, particularly male staff, were also noted. Cultural misconceptions limit discussion and cause stigma and absenteeism. Expensive or inaccessible menstrual products force some girls to use unsafe alternatives.

Facilitators and opportunities for implementation of the informational guide to menstrual health

On a more optimistic note, participants identified several facilitators that could support the guide's implementation. The powerful tool for spreading accurate information, especially among youth is the social media. Community-based organizations already active in distributing sanitary products and bins were recognized for their contributions. Existing health talks in schools, though underutilized, were viewed as potential channels for menstrual hygiene education. Supportive policies and governance, including multi-sectoral coordination and political goodwill, were considered crucial for overcoming economic barriers and ensuring equitable access.

Finally, the idea of learner-led WASH clubs was proposed as a means of fostering peer influence and ownership. These clubs could empower students to lead conversations, share experiences, and normalize menstrual hygiene practices within their schools.

In summary, the experts' dialogue on the informational guide to menstrual health in schools highlighted a shared recognition of its importance in promoting health, dignity, and educational equity for girls. Participants affirmed that the guide serves as a valuable resource not only for learners but also for educators, offering a structured reference to address menstrual health comprehensively. The conversation underscored the need for a supportive environment particularly access to clean water as a foundational element of effective menstrual hygiene practices.

While the guide was widely endorsed, the discussion revealed several implementation challenges. These include inadequate funding, limited access to menstrual products, persistent cultural myths, and gaps in awareness especially among male stakeholders. Despite these barriers, participants identified numerous facilitators such as existing health clubs, community-based organizations, social media platforms, and supportive governance structures that could be leveraged to enhance the guide's impact.

Overall, the guide was seen as a timely and necessary intervention that, if well-implemented, could transform menstrual hygiene management in schools and contribute to improved health outcomes and school attendance for girls.

7.2.2 PRONG 2: OPERATIONAL INTERVENTIONS - WASH PYRAMID FRAMEWORK FOR PANDEMIC PREPAREDNESS AND INFECTION CONTROL IN PRIMARY SCHOOLS IN KENYA

The proposed intervention which was WASH pyramid framework for pandemic preparedness and infection control in primary schools in Kenya was presented to the experts and it elicited the findings presented in this section. The WASH pyramid framework has been presented in chapter 7 as part of this dissertation.

General Views on the WASH pyramid framework

The experts expressed broad support for the WASH pyramid framework, acknowledging its feasibility and potential for impactful implementation. However, several concerns were raised regarding the foundational elements necessary for its success. One of the primary issues discussed was the inadequacy of existing policies, particularly at the county and sub-county levels. While national sanitation policies exist, they often lack depth and specificity, especially in addressing sanitation beyond water distribution. Participants emphasized the need for policy realignment and integration of sanitation into local governance structures to ensure the framework reaches communities effectively.

Implementation Strategies

The experts' dialogue called for policy realignment and integration of WASH into budgeting processes.

The experts advocated for a movement that pushes for integrated budgeting and increased funding allocations for WASH initiatives. The dialogue also highlighted the importance of stakeholder engagement. Participants agreed that the framework would only be successful if all relevant parties including government officials, educators, and community leaders were involved in its planning and execution. It was observed that there was need for inclusive, disability-friendly environments in schools to ensure access to WASH facilities for all learners.

Stakeholders identified

Involvement of government officials, educators, and community leaders was emphasized from the planning of the intervention to its execution.

Emphasis on multi-sectorial collaboration and top leadership involvement to ensure sustainability was made. Experts stressed the need for community-level engagement to reach grass root populations**.**

Barriers to Implementation of the WASH pyramid framework

Barriers to implementation were also discussed. Resistance to change within communities was cited as a significant challenge; deeply rooted beliefs and practices may slow adoption. Poverty was another concern, with families often prioritizing basic needs like food over hygiene products. Sustainability was questioned, with some stakeholders worried about whether the framework could be maintained long-term without consistent leadership and support.

Budget constraints were another recurring theme. Experts noted that sanitation typically receives minimal financial support compared to other sectors, which could hinder the framework's rollout.

Facilitators and opportunities for implementation of the WASH pyramid framework

Schools were identified as strategic platforms for intervention, especially given the infrastructure improvements made during the COVID-19 pandemic, such as the installation of hand washing stations. These facilities, though currently underutilized, could be revitalized to support the framework.

Education emerged as a key facilitator, with stakeholders pointing to the new curriculum design that includes WASH topics. Teachers, despite their heavy workloads, were seen as essential agents in promoting hygiene awareness among students. Additionally, the availability of reusable menstrual pads was recognized as a positive development that could be scaled up to support girls' hygiene needs. The new competency-based curriculum includes WASH topics, offering a platform for awareness and education.

In conclusion, while experts acknowledged the hurdles ahead, they remained optimistic about the framework's potential. With proper policy support, adequate funding, and inclusive stakeholder engagement, the WASH pyramid framework could become a sustainable and transformative tool for pandemic preparedness and infection control.

7.2.3 PRONG 3: STRATEGIC INTERVENTION - POLICY BRIEF: BUILDING RESILIENT SCHOOL HEALTH SYSTEMS THROUGH WASH PYRAMID FRAMEWORK IN KENYA

The proposed intervention which was a policy brief: Building Resilient School Health Systems through WASH Pyramid Framework in Kenya was presented to the experts and it elicited the findings presented in this section. The policy brief has been presented in chapter 7 as part of this dissertation.

General views on the policy brief

The dialogue surrounding the WASH pandemic preparedness policy brief revealed strong support for the proposed intervention, with stakeholders acknowledging its relevance and effectiveness in addressing real-world sanitation and hygiene challenges. Participants appreciated that the policy was grounded in research data, which lends credibility and direction to its recommendations. However, they emphasized the importance of inclusive stakeholder participation in its development and implementation.

Implementation Strategies of the policy brief

Implementation strategies focused heavily on awareness creation. Stakeholders stressed that every participant from grassroots to institutional levels should understand their roles and responsibilities. The conversation highlighted the need for comprehensive stakeholder mapping, identifying key groups such as market vendors, business owners, school administrators, religious leaders, youth groups, people with

disabilities, and opinion leaders. The inclusion of private sector entities like Safaricom was also proposed, given their potential to support implementation efforts.

Sustainability emerged as a central concern. Participants noted that long-term success would depend on integrating WASH into school and community budgets, encouraging parental involvement, and empowering school boards of management to allocate and mobilize resources.

The formation of monitoring and evaluation teams was recommended to ensure continuity and accountability, preventing the initiative from losing momentum over time.

Stakeholders identified

Suggestions were made to involve a wide range of actors, including learners, teachers, parents, community organizations, and both county and national government representatives.

Stakeholders should include market vendors, business owners, religious institutions, women's groups, youth groups, and groups representing people with disabilities.

The experts also proposed the inclusion of opinion leaders and peer educators, political leaders and aspirants to be sensitized so that in case they take up the political positions they can be the advocates for the intervention.

Facilitators and opportunities for implementation of the policy brief

Several facilitators were identified that could support the policy's rollout. These included existing income-generating activities in schools, which could be leveraged to fund WASH programs, and religious institutions, which offer influential platforms for community engagement. School boards and curriculum structures were also seen as assets that could reinforce hygiene education and practice.

Barriers to implementation of the policy brief

Despite these positives, stakeholders acknowledged significant barriers. Budget limitations were cited as the most pressing challenge, with concerns about whether policymakers would prioritize WASH in financial planning. Additionally, a lack of goodwill from certain stakeholders could obstruct policy

adoption and implementation. Disruptions in teaching schedules were also mentioned as a potential hindrance to consistent delivery of WASH-related content. In conclusion, the policy brief dialogue underscored a shared commitment to improving WASH preparedness through a well-informed, inclusive, and sustainable policy framework. With strategic planning, stakeholder engagement, and adequate funding, the proposed intervention holds promise for transforming hygiene standards in schools and communities alike.

7.5 IMPLEMENTATION PLAN FOR THE PROPOSED THREE-PRONGED WASH INTERVENTION STRATEGY

Overview

The implementation plan operationalizes the three developed interventions by translating them into actionable steps across learner, school, and policy levels. The plan is aligned with Kenya's devolved governance structure, existing School Health frameworks, and stakeholder roles identified during the validation workshop. Implementation is based on multi-sectoral collaboration, inclusivity, sustainability, and integration into existing systems.

INTERVENTION 1: LEARNER-CENTERED INTERVENTION

Informational Guide to Menstrual Health in Primary Schools

Implementation Objective

To improve menstrual health knowledge, preparedness, and hygienic practices among primary school learners especially girls and learners with disabilities through structured, accessible, and age-appropriate information. Table 21 outlines the implantation plan for learner-centered intervention that is the informational guide to menstrual health in primary schools

Table 21: Implementation Plan learner centered intervention

Component	Who (Responsible actors)	How (Implementation approach)	Resources Required

Development & finalization of guide	Researcher, Ministry of Education, Ministry of Health, curriculum experts, disability advocates	Review and finalize guide content; adapt language for age and disability inclusivity; approve for school use	Technical expertise, printing/editing costs, disability inclusive content review
Dissemination to schools	County Education Offices, School Heads, Teachers, School Boards (BoMs)	Distribute guide in print and audio formats; store copies in staff rooms, libraries, and health offices	Printed booklets, audio recordings, storage cabinets
Integration into school activities	Teachers, School Health Coordinators, WASH clubs	Use guide during life skills lessons, health talks, school assemblies, club activities	Lesson time, training guides, facilitation materials
Capacity building	Teachers, School nurses, Community Health Workers (CHEWs)	Conduct sensitization and training sessions on menstrual health and inclusive delivery	Training manuals, venues, facilitation allowances
Parental & community engagement	Parents, PTAs, Community leaders, NGOs, Religious institutions	Hold dialogue forums, community barazas, and parental meetings to address myths and taboos	Meeting spaces, IEC materials, transport facilitation
Supportive school environment	School management, County Government	Ensure water availability, disposal bins, emergency menstrual products	Water supply, sanitary bins, menstrual products
Monitoring & feedback	Teachers, WASH clubs, County School Health teams	Monitor use of guide, collect feedback from learners and teachers	Monitoring tools, reporting templates

INTERVENTION 2: OPERATIONAL INTERVENTION

WASH Pyramid Framework for Pandemic Preparedness and Infection Control

Implementation Objective

To strengthen school-level systems for infection prevention, preparedness, response, and recovery through a structured, layered WASH framework. Table 22 outlines the implantation plan for operational intervention that is the WASH Pyramid Framework for Pandemic Preparedness and Infection Control

Table 22: Implementation Plan learner centered intervention

Pyramid Layer	Who	How	Resources Required

Governance (Base layer)	National & County Governments, Ministries of Education, Health & Water, School Boards	Integrate WASH into CIDPs and School Development Plans; establish School WASH Emergency Committees; clarify roles	Policy documents, coordination meetings, M&E tools
Core WASH Infrastructure	County Governments, School Boards, NGOs	Construct/rehabilitate water points, toilets, hand washing stations; ensure disability friendly and gender sensitive design	Infrastructure funding, construction materials, technical expertise
Preparedness	Teachers, CHEWs, School management	Stock hygiene supplies; train staff; integrate WASH & pandemic topics into curriculum; improve ventilation; promote digital hygiene education	Soap, masks, disinfectants, training materials, ICT tools
Response	School Health Committees, Public Health Officers	Activate screening, isolation spaces, intensified cleaning, health alerts and communication	Thermometers, PPE, isolation rooms, communication tools
Recovery (Apex)	School leadership, Counselors, Education officers	Provide psychosocial support; conduct catch up learning; repair infrastructure; review response lessons	Counseling services, learning materials, repair funds
Cross cutting themes	All stakeholders	Ensure inclusivity, equity, and digital literacy at all levels	Assistive devices, training resources, ICT infrastructure

INTERVENTION 3: STRATEGIC INTERVENTION

Policy Brief – Building Resilient School Health Systems through the WASH Pyramid Framework

Implementation Objective

To institutionalize WASH pandemic preparedness within governance, planning, and financing systems at national and county levels. Table 23 outlines the implementation plan for strategic intervention that is the policy brief.

Table 23: Implementation Plan learner centered intervention

Policy Action Area	Who	How	Resources Required
Policy adoption & advocacy	Ministry of Education, Ministry of Health, County Governments, Parliamentarians	Present policy brief to decision makers; advocate through forums and technical working groups	Advocacy forums, briefing documents

Integration into planning	County planners, education officers	Embed WASH Pyramid framework into CIDPs and education sector plans	Planning expertise, policy harmonization meetings
Budgeting & financing	National & County Treasuries, School Boards	Allocate dedicated WASH budgets; support emergency WASH funds; leverage income generating activities	Financial resources, budget lines
Stakeholder engagement	Government, NGOs, private sector, CBOs, religious institutions	Conduct stakeholder mapping; establish multi sectoral coordination platforms	Coordination staff, meeting logistics
Monitoring & accountability	County M&E units, School Boards, Civil society	Establish monitoring teams; use dashboards and reporting tools	M&E tools, data systems
Sustainability & scale up	Policymakers, Development partners	Institutionalize WASH standards; replicate framework nationally	Long term funding, technical support

SUMMARY OF RESOURCE REQUIREMENTS (CROSS-CUTTING)

- **Human resources:** teachers, CHEWs, public health officers, planners, counselors
- **Financial resources:** school and county budget allocations, donor funding
- **Material resources:** water infrastructure, sanitation facilities, menstrual products, hygiene supplies
- **Technical resources:** policy expertise, disability-inclusive design knowledge
- **Digital resources:** mobile phones, dashboards, audio learning tools

7.6 COMPARISON OF EXPERT CONSENSUS WITH RANKING PRIORITIES OF INTERVENTIONS DEVELOPED

Although the study did not present a formal ranking of intervention components, the prioritization of WASH interventions was derived from the strength of expert consensus, as reflected in high agreement levels (74%–100%) and mean scores (4.5–4.8) in table 24, with the most strongly endorsed domains informing the development of the three-pronged intervention strategy.

Table 24: Consensus statistics verses intervention priorities

Expert Consensus Evidence	Corresponding Intervention Priority	Interpretation
Agreement: 74%–100%	All major intervention domains	All proposed elements were endorsed as relevant

Mean scores: 4.5–4.8	High-priority intervention components	Indicates strong agreement on importance
Strong consensus on governance	Policy brief component	Governance is a top system-level priority
Strong consensus on budgeting	Policy and operational intervention	Financial sustainability identified as critical
Strong consensus on inclusive infrastructure	WASH Pyramid framework	Infrastructure seen as foundational
Strong consensus on MHM	Learner-centered intervention	Gender-sensitive interventions prioritized
Strong consensus on curriculum integration	Behavior change and school programs	Emphasis on sustainability through education
Strong consensus on capacity building	System strengthening	Long-term implementation requirement
Strong consensus on monitoring systems	Governance and evaluation structures	Accountability and continuity prioritized

7.3 CONCLUSION

The proposed three-pronged WASH intervention strategy comprising learner-centered, operational, and strategic components offers a comprehensive and sustainable framework for enhancing WASH standards in Kenyan primary schools. The workshop held in Eldoret City brought together a diverse group of stakeholders whose insights affirmed the relevance, feasibility, and transformative potential of these interventions.

The learner-centered approach, anchored by the informational guide to menstrual health, was widely endorsed for its role in promoting dignity, health, and educational equity, especially for girls. Experts emphasized the need for inclusive education, parental involvement, and policy integration to overcome cultural taboos and resource limitations.

The operational intervention, represented by the WASH pyramid framework, was praised for its structured design and alignment with pandemic preparedness goals. However, its success hinges on policy realignment, inclusive budgeting, and multi-sectoral collaboration to ensure long-term sustainability and grassroots impact.

The strategic intervention, articulated through the policy brief, was recognized as a vital tool for institutionalizing WASH priorities within governance systems. Stakeholders highlighted the importance

of broad-based awareness, stakeholder mapping, and private sector engagement to drive implementation and accountability.

Across all three prongs, the following recurring themes emerged: the need for adequate funding, inclusive stakeholder engagement, supportive policies, and community-driven advocacy. Despite challenges such as budget constraints, cultural resistance, and logistical hurdles, the presence of existing infrastructure, curriculum support, and grassroots organizations presents a fertile ground for success.

The proposed WASH interventions represent a timely and necessary response to the health and hygiene challenges facing Kenyan schools. Coordinated action, political support, and ongoing investment can greatly enhance student well-being, lower absenteeism, and strengthen school health systems for the future.

Connecting text

Chapter 7 presented the findings of the short-term outcome evaluation of the developed three-pronged WASH intervention strategy. Through stakeholder validation workshops, WASH experts confirmed the feasibility, acceptability, and relevance of the menstrual health guide, WASH Pyramid Framework, and policy brief for strengthening infection prevention and pandemic preparedness in primary schools. The chapter also highlighted key facilitators, barriers, and implementation considerations for successful adoption of the interventions.

Building on these validation findings, Chapter 8 concludes the thesis by synthesizing the overall contribution of the study to school WASH implementation. The chapter discusses the conceptual, empirical, and practical contributions of the research.

CHAPTER 8: OVERALL CONTRIBUTION OF THE STUDY TO WASH IMPLEMENTATION IN PRIMARY SCHOOLS

8.1 Introduction

This chapter presents the overall contribution of the study, with particular emphasis on its contribution to Water, Sanitation and Hygiene (WASH) implementation in primary schools. While preceding chapters addressed the background, evidence base, methodology, empirical findings, intervention development, and validation, this final chapter synthesizes the original, practical, and policy-relevant contributions arising from the study.

The chapter demonstrates how the research advances knowledge and practice by moving beyond descriptive assessments of WASH conditions to the design, validation, and contextualization of implementable solutions for improving school WASH systems. The contributions are discussed across four interrelated domains: conceptual, empirical, intervention, and policy/practice contributions.

8.2 Conceptual contribution to school WASH implementation

A key contribution of this study is the conceptual strengthening of WASH implementation in school settings. The study advances existing frameworks by adapting and operationalizing the WASH FIT framework, integrated with a Logic Model and Theory of Change, specifically for primary schools and pandemic preparedness (Kellogg, 2004; Weber *et al*., 2019).

Unlike many previous studies that treat WASH infrastructure, hygiene behavior, and policy as separate domains, this research conceptualizes WASH implementation as a systems-based, layered process. Through the development of the WASH Pyramid Framework, the study introduces a novel way of visualizing and sequencing WASH interventions from foundational inputs such as water and sanitation infrastructure, through hygiene behaviors and management systems, to higher-level policy and governance mechanisms (WHO,2010; UNICEF, 2024)

This conceptual contribution is particularly important for implementation because it:

- Clarifies dependencies between WASH components, helping schools and policymakers prioritize actions;

- Emphasizes that behavioral and management interventions cannot succeed without functional infrastructure;
- Positions WASH within pandemic preparedness and infection prevention frameworks, extending its relevance beyond routine school health programming.

8.3 Empirical contribution to understanding WASH implementation gaps

The study makes a substantial empirical contribution by providing context-specific, systematically collected evidence on the status of WASH implementation in primary schools in Uasin Gishu County, Kenya. Using a mixed-methods case study approach across 51 schools, the research moves beyond aggregate national indicators to reveal implementation-level realities within schools.

Key empirical contributions include:

- Identification of persistent inequities in WASH implementation between rural and urban schools, and between public and private schools;
- Evidence of weaknesses in water quality monitoring, operation and maintenance systems, and disability-inclusive infrastructure;
- Documentation of gaps in menstrual hygiene management, particularly the absence of changing rooms, disposal systems, and teacher training;
- Demonstration that the presence of policies does not guarantee implementation, highlighting weak translation of national WASH guidelines into school-level practice.

By explicitly linking these findings to the WASH FIT input–activity–outcome continuum, the study generates implementation-relevant evidence that can guide targeted improvements rather than generic interventions (Creswell, 2014; Yin, 2009).

8.4 Contribution through development of practical WASH interventions

One of the most significant contributions of this thesis lies in its translation of evidence into actionable WASH interventions. Unlike many studies that end with recommendations, this research designed, articulated, and validated implementable tools for schools and stakeholders (Okoli and Pawlowski, 2004).

8.4.1 Learner-Centered contribution: menstrual health informational guide

The development of an informational guide to menstrual health for primary schools represents a direct contribution to improving gender equity, school attendance, and dignity for girls. The guide fills a critical implementation gap by:

- Providing age-appropriate, contextually relevant menstrual health information;
- Supporting teachers who lack formal training in menstrual hygiene management;
- Standardizing menstrual health messaging within schools.

This contribution is particularly significant for implementation, as it offers a low-cost, scalable intervention that can be integrated into routine school health activities.

8.4.2 Operational contribution: WASH Pyramid Framework

The WASH Pyramid Framework is a central implementation contribution of this study. It provides schools, education managers, and WASH practitioners with a practical operational model for strengthening WASH systems in stages. The framework:

- Aligns infrastructure development with hygiene promotion, operation and maintenance, and governance;
- Supports schools to systematically identify which level of WASH implementation is weakest;
- Enhance preparedness for infectious disease outbreaks by embedding WASH into routine risk-reduction practices.

This framework advances WASH implementation by transforming abstract policy goals into a usable planning and monitoring tool.

8.4.3 Strategic contribution: Policy brief for institutionalization of WASH

The policy brief developed as part of the study contributes to sustained WASH implementation by bridging the gap between research evidence and decision-making. It synthesizes findings from all study phases into clear, actionable policy messages targeted at government and institutional stakeholders.

This contribution strengthens WASH implementation by:

- Promoting inter-sectoral coordination between health, education, and water sectors;
- Advocating for budgeting and accountability mechanisms for school WASH;
- Supporting institutionalization of WASH within school health systems.

8.5 Future research directions arising from this study

While this research study provides robust empirical evidence and develops validated, context-specific interventions for strengthening WASH implementation in primary schools, several areas warrant further investigation. The findings, methodological scope, and intervention focus of the thesis point to important directions for future research, particularly in advancing sustainable, scalable, and impact-oriented WASH programming in school settings.

8.5.1 Long-term impact evaluation of the developed WASH interventions

This study conducted a short-term outcome evaluation focusing on feasibility and acceptability of the three-pronged WASH intervention strategy. Future research should therefore examine the long-term effectiveness and impact of these interventions once fully implemented in schools.

8.5.2 Effectiveness trials of the WASH pyramid framework

The WASH Pyramid Framework developed in this thesis represents a novel operational and conceptual model for school-based WASH implementation. Future research should move beyond validation to conduct implementation and effectiveness trials of the framework across diverse school contexts.

8.5.3 Economic and Cost-effectiveness analyses of school WASH interventions

Although this study identified cost-effective elements during the scoping review, it did not conduct a formal economic evaluation of the developed interventions. Future research should therefore focus on cost-effectiveness and cost–benefit analyses of school WASH interventions.

8.5.4 Inclusive WASH research for learners with disabilities

A major empirical finding of this study was the limited disability-inclusive WASH infrastructure in many schools. Future research should prioritize inclusive WASH by focusing specifically on learners with physical, sensory, and cognitive disabilities.

8.5.5 Integration of school WASH with comprehensive pandemic preparedness frameworks

This thesis positions WASH as a core pillar of pandemic preparedness in schools. Future research should further explore the integration of WASH interventions with broader school emergency preparedness and infection prevention systems.

8.5.6 Policy implementation and governance studies on school WASH

The study identified gaps between existing policies and actual implementation of WASH in schools. Future research should therefore focus on policy implementation research, examining how governance, financing, and accountability mechanisms shape WASH outcomes.

8.5.7 Teacher training and curriculum-based WASH 1nterventions

Given the limited regular training reported among teachers in this study, future research should assess WASH-focused teacher training models and curriculum-embedded interventions.

Connecting text

Chapter 8 presented the overall contribution of the study to Water, Sanitation and Hygiene (WASH) implementation in primary schools by highlighting the conceptual, empirical, and practical contributions of the research.

Building on these contributions, Chapter 9 provides a comprehensive synthesis and integration of findings across all phases of the study. The chapter demonstrates how the evidence generated from the literature review, empirical assessment, expert consensus process, intervention development, and validation phases collectively contributed to the development of a context-specific three-pronged WASH intervention strategy for strengthening infection prevention, school health systems, and pandemic preparedness in primary schools. The chapter also presents strengths and limitations of the study, recommendations for policy and practice levels, for scaling the proposed intervention and sustainability, and provides the overall conclusions of the study.

9.1 Introduction

This chapter provides an integrative synthesis of the study, bringing together the conceptual, empirical, and applied components of the research. The study adopted a multi-phase, mixed-methods case study design, progressing systematically from evidence mapping and contextual analysis to intervention development and validation. This structure ensured coherence across phases and facilitated the linkage between research objectives, methods, and outcomes, consistent with methodological guidance for complex health systems research (Creswell, 2014; Yin, 2009). The synthesis highlights how findings from each phase informed the development of a context-specific, system-strengthening Water, Sanitation and Hygiene (WASH) intervention for primary schools in Uasin Gishu County, Kenya.

9.2 Background of the Developed WASH Interventions

The development of the WASH intervention was grounded in three complementary sources of evidence: global literature on school WASH in low- and middle-income countries, empirical findings from primary schools in Uasin Gishu County, and expert consensus generated through the Delphi technique. Evidence synthesis and document analysis approaches used in this study align with established methodologies for policy and health systems research (Bowen, 2009; Fallah *et al.* 2023).

The need for intervention development emerged from persistent gaps identified across these domains, including inadequate infrastructure, weak policy implementation, limited monitoring systems, and insufficient integration of menstrual hygiene management (MHM) into school health programs (WHO & UNICEF, 2020; Ministry of Education, Ministry of Health and Ministry of Water Sanitation and Irrigation, 2024).

The conceptual basis of the intervention was anchored in the WASH FIT framework, the Logic Model, and the Theory of Change, which collectively provide a structured approach to linking inputs, processes, and outcomes in health system strengthening (Weber et al., 2019; World Health Organization, 2018).

In response, the study developed a three-pronged WASH intervention strategy, consisting of:

1. A learner-centered menstrual health informational guide, addressing gender inequities, stigma, and knowledge gaps in menstrual hygiene management (Sommer *et al.* 2021; UNESCO, 2023).
2. A WASH Pyramid Framework, designed to strengthen school-level systems through integrated attention to infrastructure, behavior change, governance, and monitoring, consistent with systems-based approaches to public health interventions (WHO, 2010).
3. A policy brief on resilient school health systems, aimed at improving governance, financing, and sustainability of WASH interventions at institutional and policy levels (Ministry of Education *et al*. 2024).

These components collectively address individual, institutional, and policy-level determinants of WASH implementation, reflecting a socio-ecological and systems-oriented approach to intervention design.

9.3 Summary of Key Findings from the Developed Interventions

9.3.1 Evidence from Empirical and Global Findings

The findings revealed substantial disparities in WASH infrastructure and service delivery across schools, particularly between rural and urban settings and between public and private institutions. Similar disparities have been documented in previous studies in sub-Saharan Africa and LMIC contexts (WHO/UNICEF JMP, 2024; UNICEF, 2024).

Key challenges identified included:

- Inadequate disability-friendly WASH infrastructure
- Limited availability of soap and functional handwashing facilities
- Weak implementation of WASH policies at school level
- Gaps in menstrual hygiene management facilities

These findings are consistent with existing literature demonstrating that WASH interventions are often poorly implemented due to weak institutional systems, insufficient funding, and lack of monitoring mechanisms (Hope & Tanui, 2021; Njambi *et al.* 2020).

9.3.2 Findings from Delphi Expert Consensus

The Delphi process established strong consensus among experts on critical elements required to strengthen school WASH systems. Consensus-based approaches are recognized as effective in generating context-specific solutions in complex system environments (Okoli & Pawlowski, 2004).

Key priorities identified included:

- Strengthening governance and accountability structures
- Establishing dedicated budget lines for WASH
- Promoting inclusive and disability-friendly infrastructure
- Integrating menstrual hygiene management into school curricula
- Enhancing monitoring and evaluation systems
- Strengthening multi-sectoral collaboration

These findings align with global recommendations emphasizing system-wide approaches rather than isolated interventions (WHO & UNICEF, 2020).

9.3.3 Findings from Intervention Validation (Phase 3)

The stakeholder validation process confirmed that the developed interventions were feasible, acceptable, and contextually appropriate. Stakeholder involvement is critical for enhancing implementation success and sustainability of public health interventions (Kaplan & Garrett, 2005).

Experts identified several facilitators:

- Existing infrastructure and institutional structures
- Integration of WASH into school curricula

- Multi-sectoral collaboration

However, key barriers included:

- Inadequate funding
- Cultural constraints related to MHM
- Weak policy enforcement mechanisms

These findings underscore the importance of addressing both structural and sociocultural factors in WASH implementation (Sommer *et al*. 2021). Table 25 provides key summary findings obtained from the study in line with research question answered by the study.

Table 25:Summary of Key findings

Research Questions	**Key Findings of the Study**	**Developed Intervention Component**
What are the WASH interventions in primary schools in Low- and Middle-Income Countries?	Global evidence shows that WASH interventions are often fragmented and context-dependent; effective interventions are multi-component, integrating infrastructure, behavior change, and governance; limited attention to menstrual hygiene management (MHM), monitoring, and sustainability	Informed the overall design of the Three-Pronged WASH Intervention Strategy, particularly the development of the WASH Pyramid Framework as an integrated system-strengthening model
What is the input in schools for the implementation of WASH programs in Uasin Gishu County?	Schools had partial WASH infrastructure; many lacked soap, disability-friendly facilities, and adequate water systems; limited financial resources and infrastructure disparities between public and private schools	Informed the Operational Intervention (WASH Pyramid Framework) focusing on strengthening infrastructure, financing, and resource allocation
What are the activities of the WASH program in primary schools in Uasin Gishu County?	WASH activities were inconsistently implemented; reliance on teachers and school management; weak coordination, limited hygiene promotion, and minimal integration of WASH into school systems	Guided the development of the WASH Pyramid Framework, emphasizing coordinated implementation, capacity building, and structured operational systems

What are the outcomes of WASH interventions in primary schools in Uasin Gishu County?	Outcomes were suboptimal due to poor maintenance, lack of soap, inadequate monitoring systems, and weak policy implementation; persistent hygiene gaps and limited behavior change observed	Informed both the WASH Pyramid Framework (monitoring and outcomes focus) and the Policy Brief (accountability and evaluation systems)
Who should be involved in the implementation of WASH programs in primary schools?	Experts identified key stakeholders including school management, teachers, government agencies, public health officials, NGOs, and community members; highlighted need for multi-sectoral collaboration	Informed the Policy Brief (governance and stakeholder coordination) and reinforced multi-level structure of the WASH Pyramid Framework
What should be included in WASH interventions in primary schools?	Experts prioritized inclusive infrastructure, MHM integration, governance systems, funding mechanisms, hygiene education, and monitoring systems	Informed all three intervention components: • Menstrual Health Guide (learner-level) • WASH Pyramid Framework (operational-level) • Policy Brief (strategic-level)
How should WASH interventions be implemented in primary schools?	Effective implementation requires structured systems, clear roles, stakeholder coordination, continuous monitoring, and integration into school curricula; current implementation is fragmented	Led to the development of the WASH Pyramid Framework, which provides a structured, layered implementation model for schools
What are the short-term outcomes of the developed WASH interventions?	Experts confirmed that the interventions were feasible, acceptable, and contextually relevant; identified facilitators (existing structures, collaboration) and barriers (funding, cultural issues, sustainability)	Validated and refined all three interventions, ensuring practical applicability and sustainability: • Menstrual Health Guide • WASH Pyramid Framework • Policy Brief

9.4 Strengths of the Study

The study demonstrates several notable strengths that collectively enhance its credibility, relevance, and practical impact. By employing a mixed methods design, the researchers integrated both qualitative and quantitative approaches, enabling comprehensive analysis and triangulation of findings. This methodological rigor significantly strengthened the validity and reliability of the results (Creswell, 2014; Schoonenboom & Johnson, 2017).

Equally important was the strong theoretical grounding of the study. The use of WASH FIT, the Logic Model, and the Theory of Change provided conceptual coherence and facilitated a systematic examination of inputs, outputs, outcomes, and impacts (Weber et al., 2019). This ensured that the research was not only methodologically sound but also theoretically robust.

Another strength lies in the integration of diverse evidence sources. By combining global frameworks, empirical data, and expert insights, the study produced findings that were both robust and broadly applicable, thereby improving their relevance across different contexts (Bowen, 2009). Beyond analysis, the study advanced practical solutions by developing a three-pronged intervention tailored to the local context. These interventions are actionable and scalable, making them particularly valuable for implementation in similar low- and middle-income country settings.

Finally, stakeholder engagement and validation played a crucial role. The continuous involvement of WASH experts throughout the process enhanced ownership, acceptability, and feasibility of the interventions, increasing the likelihood of successful adoption and long-term impact (Rowe & Wright, 1999).

9.5 Limitations of the Study

While this study provides valuable insights and practical solutions for WASH implementation in schools, some limitations should be acknowledged. First, the research was confined to Uasin Gishu County, which restricts the geographical scope and may limit the transferability of findings to other contexts with different socio-economic conditions (Yin, 2009). In addition, the reliance on a case study design means that the conclusions are based on analytical rather than statistical generalization, which inherently constrains broader applicability (Yin, 2003).

Although multiple data sources were used, some findings relied on self-reported information from school staff, which may have been subject to recall bias or social desirability bias. This limitation was mitigated through observation checklists, document analysis, and data triangulation (Polit & Beck, 2004). Another limitation is the short-term evaluation of interventions. The focus was primarily on feasibility and acceptability, without assessing long-term impacts such as reductions in disease burden.

Finally, resource and logistical constraints posed challenges. Due to time and funding limitations, the study did not include large-scale field implementation of the developed interventions, which restricts the ability to fully test their effectiveness and scalability.

9.6 General Conclusion of the study

The study concludes that effective implementation of Water, Sanitation and Hygiene (WASH) interventions in primary schools require more than the provision of basic infrastructure. While WASH is widely recognized as essential for child health and disease prevention, implementation in low- and middle-income settings remains inconsistent and inadequately sustained. Findings from Uasin Gishu County highlight significant disparities in WASH practice across school types and locations, with persistent gaps in water quality monitoring, maintenance systems, menstrual hygiene management, disability-inclusive facilities, and policy implementation. In response, the study developed and validated a context-specific, three-pronged WASH intervention that was found to be feasible, acceptable, and relevant to the local context. Overall, the study demonstrates that integrated, system-based WASH approaches combining infrastructure, behavior change, governance, and policy support are critical for strengthening infection prevention, enhancing school resilience, and improving pandemic preparedness.

9.7 Recommendations

Based on the findings and validated interventions of this study, the following recommendations are proposed for policy, practice, and research to strengthen WASH implementation in primary schools.

9.7.1 Policy-level recommendations

1. National and county governments should institutionalize school WASH frameworks, such as the WASH Pyramid Framework, within existing school health and pandemic preparedness policies.

2. Ministries responsible for education, health, water, and sanitation should strengthen inter-sectoral coordination mechanisms to ensure coherent planning, budgeting, and accountability for school WASH.
3. Dedicated ring-fenced budget lines for operation, maintenance, and water quality monitoring in schools should be prioritized alongside infrastructure development.

9.7.2 Practice-Level recommendations

1. Primary schools should adopt a phased and systems-based approach to WASH implementation, beginning with functional infrastructure and progressing to hygiene promotion, management systems, and governance.
2. Routine water quality testing and monitoring should be strengthened and supported through clear guidance and technical assistance.
3. Menstrual Hygiene Management (MHM) should be fully integrated into school WASH programming through provision of changing spaces, disposal systems, menstrual products, and structured menstrual health education.
4. Disability-inclusive WASH infrastructure should be prioritized to ensure equitable access for all learners.
5. Teachers and school leaders should receive regular training on WASH, hygiene promotion, and infection prevention, enabling them to act as change agents within schools.

9.7.3 Recommendations for scaling and sustainability

1. The three-pronged WASH intervention strategy should be piloted and scaled across additional counties to test adaptability and sustainability.
2. Community participation, including parents and local leadership, should be strengthened to enhance ownership and long-term maintenance of school WASH systems.
3. Monitoring and evaluation mechanisms should be integrated into routine school supervision systems to track WASH performance and guide continuous improvement.

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Chapter 8

APPENDICES

Appendix I: Structured questionnaire to the head teachers

#	QUESTION	RESPONSES	SKIP LOGIC
	SECTION A: GENERAL INFORMATION OF THE PRIMARY SCHOOL		
A01.	Date of the inspection	(dd/mm/yy):	
A02.	Time of the inspection	(hh/mm):	
A03.	Interview identification no. school staff		
A04.	Position of the interviewed school staff member(s)		
A05.	Which sub-county is the school situated		
A06.	School location (GPS)		
A07.	What type of area is the school located in?	1. Rural 2. Urban	
A08.	How many years has the school been in existence?		
A09. .	Residential nature of school	1. Day school only 2. Day and boarding 3. Boarding only	
A10.	How many students attend the school?	……..	
A11.	How many are boys	……	

A12.	How many are girls	……	
A13.	What is the age of the youngest pupil?		
A14.	What is the age of the oldest pupil?		
A15.	G17. How many staff members does the school have?	1.Total number of staff: _____ 2.Number of female staff: ____ 3.Number of male staff: _____ 4.Number of teachers: 1.male 2. Female 5. Number of administrative staff: _____ 6. Number of operation and maintenance staff:_____	
A16.	How many students with limited mobility attend the school?		
A17.	When was the school built?	1.Main building _____Yrs. ago 2. Extension (if applicable): ___Yrs. ago	
A18.	Was the building designed to serve as an educational institution?	1.Yes, it was designed to serve that purpose 2. No, but it was adapted for that purpose 3. No	
Q1: What are the inputs in schools for the implementation of WASH program in public primary schools in Uasin Gishu County			
SECTION B: SCHOOL WASH INPUTS, BI. School WASH Policy guidelines and implementation			
B01.	Does the School have WASH policy guidelines?	1. Yes 2. No	
B02.	Is the School implementing the WASH policy guidelines?	1. Yes 2. No	
B03.	What are the elements of the School WASH have been implemented in your school? *Can have multiple answers*	1. Safe water 2. Environmental Sanitation 3. School hygiene 4. Infrastructure 5. Food safety	

		6. Vector, vermin and Rodents 7. Other (specify)	
B04.	Are there clear roles and responsibilities for school WASH program at the national and County government?	1. Yes 2. No	
B05.	Who is responsible for providing the budget for the operation and maintenance of WASH services at the school? (Multiple response)	1.School administration 2. Local public administration 3.Parents of the pupils 4. Other (please specify):	YES, NO, N/A
B07.	Who is responsible for operation and maintenance of the WASH facilities on the school promises?	1.External provider 2.School management 3.Both external provider and school management 4.Other (please specify)	Water Sanitation Hygiene
B08.	Are there clear targets of WASH program in schools?	1. Yes 2. No	
B09.	To what percentage can you say you have implemented the WASH guidelines in you school	Up to 25% 25- 50% 50-75% Above 75%	
B2. Coordination of School WASH			
B10.	What is the role of the head teacher in the WASH program in the school?	1. Coordinate hygiene education and promotion 2. Maintenance of WASH facilities 3. Ensure facility operation use and care 4. Oversee construction of toilets 5. Oversee fencing and solid waste management facilities 6. Inspection of school sanitary facilities 7. Procurement of cleaning and maintenance tools	

B11.	What is the role of Board of Management in the school WASH program?	1. Approval of school WASH operation and maintenance budget 2. Inspection of WASH facilities 3. Monitoring and evaluation of school WASH program 4. Other (specify)	
B14.	Does school promote the commemoration of WASH related days by schools (Global Hand washing Day, MHM day, World Toilet Day, World Environmental Day (provide evidence)	1. Yes 2. No	
B15.	Does the school have plans of maintenance of WASH facilities?	1. Yes 2. No	
B16.	How often does the school hold WASH related meetings?	1. Once weekly 2. Once monthly 3. Once a term 4. When need arises 5. No response 6. Not applicable	
B17.	What ways does the school administration support WASH activities?	1. Provide money 2. Provide materials 3. Allocating time for meetings 4. Monitoring 5. Not specified 6. No response 7. Not applicable	
B3. Budgeting and Funding of School WASH			
B15.	Is there a budget for the operation and maintenance of WASH services at the school?	1. Yes, the budget covers more than 75% of needs 2. Yes, the budget covers between 50% and 75% of needs 3. Yes, but the budget covers less than 50% of needs 4. No	
B016.	What is your budget for operations and maintenance of WASH program in your school per term?		

B17.	Who is responsible for providing the budget for the operation and maintenance of WASH services at the school?	1. School management 2. The county government 3. The central government 4. The NGOs 5. The parents	
B18.	Do you get capitation grant meant for your School WASH program from the government?	1. Yes 2. No	
B4. Monitoring and reporting of school WASH			
B19.	Do you have a monitoring system of WASH program in your school?	1. Yes 2. No	
B20.	Who does the Monitoring of WASH program in your School?	1. The school Board of Management 2. The county Government 3. The national government 4. The NGO 5. Ministry of education 6. Ministry of health 7. No monitoring	
B21.	Do you report to anyone about WASH program in your school?	1. Yes 2. No	
B22.	Whom do you report to about WASH program?	1. The school Board of Management 2. The county Government 8. The national government 9. The NGO 10. Ministry of education 11. Ministry of health 12. No monitoring	
B25.	When was the last time your school WASH program was monitored?	1. Less than 1 year ago 2. 2 years ago 3. 3 years ago 4. 5 years ago 5. More than 6 years ago	

Q2. What are the activities of WASH program in public primary schools in Uasin Gishu County

SECTION C: SCHOOL WASH ACTIVITIES: C1. Water Interventions: Availability and Functionality			
C01.	What is the main source of drinking water provided by the school?	1. Piped water supply into school building 2. Piped water supply into school yard/plot 3. Public tap/standpipe out of school yard/plot 4. Protected well/spring 5. Rainwater 6. Unprotected well/spring 7. Packaged bottled water 8. Tanker-truck or cart 9. Surface water (lake, river stream) 10. No water source available Other (please explain)	
C02.	In the previous two weeks, was drinking-water from the main source available at the school throughout each school day?	1.Yes, all the time 2. No, there were irregular interruptions 3. No, there are regular interruptions 4. Not applicable	
C03.	If there are interruptions in the previous two weeks, when and for how long have they happened?		
C04.	If the main source is not always available, is there an alternative source of drinking water available at the school?	1. Yes (specify type) 2. No	
C05.	Are water points within the school area functional?	1 Yes 2 No	
C06.	Who is responsible for treating unsafe water in school?	☐ School management ☐ Parents	

		☐ County government ☐ Other donors ☐ No treating of unsafe water	
C2: Water Interventions: Quality Of Services, Operation And Maintenance			
D01.	Who is the provider of the main drinking water supply?	1. External provider (municipal or private) 2. The water source is school-owned 3. Unknown 4. Not applicable	
D02.	When the main drinking water supply is functional, does it Provide enough water for the needs of the school?	1. Yes 2. No 3. Not applicable	
D03.	Has the quality from the main water source ever been tested on the school premises for compliance with national standards for drinking-water?	1.Yes, within the last 12 months 2.Yes, more than 12 months ago 3. No, the water quality has never been tested 4. I don't know (DK) 5. Not applicable (NA)	
D04.	When was the quality of the main water source tested last?	1. Specify date of last test (mm/yy): _____ 2. Not applicable	
D05.	Was main water source confirmed to be safe for drinking and other uses?	Yes No	
D06.	In the past 12 months, have there been complaints about the quality and/or availability of drinking-water at the school?	1.Yes, about availability 2.Yes, about quality 3. Yes, about quality as well as availability 4. No	
D07.	In case of complaints, what measures are taken at the school?	1. Complaint is documented 2. Corrective action requested of responsible persons in the school	

		3. Corrective action requested of the responsible local authorities 4. Corrective action requested of the water Service provider 5. Test results reviewed and new tests requested 6 Secondary source for drinking-water is provided 7 Other (please specify):_____	
D08.	Who is responsible for the operation and maintenance of the drinking-water provision on the school premises?	1. School management 2. Ministry of water 3. Contracted services	
D09.	What drinking-water treatment method is used on the premises of the school?	1. Boiling 2. Chlorination 3. Filtration 4. SODIS or solar disinfection 5. Ultraviolet disinfections 6. Other (please specify): _____	
E01.	Where do pupils get their drinking water from at school? (Multiple response)	1.Taps or fountains outside the toilet facilities 2. Taps inside the toilet facilities 3. At the canteen free of charge 4. Pupils bring water from home 5. Pupils purchase water at the canteen or kiosk	
E02.	What activities are taken at the school on maintenance of water storage facilities?	1. Regular cleaning of water points with sanitizer 2. water treatment 3. Regular inspection of water supply system infrastructure to identify	

		insanitary conditions and /or damage 4. Regular flushing of water system Other (please specify)	
S1. Sanitation Interventions: Availability			
F01.	How many toilets cubicles/latrines are currently available to pupils?	Insert number_____	
F02.	Are there toilet facilities for staff (separate from pupils' toilet facilities) at the school?	1. Yes 2. No	
F03.	Have there been any issues with the functionality of pupils' toilets/latrines in the current school year?	1. Yes, but they have been solved 2. Yes, and they haven't been solved yet 3. No, pupils' toilets/latrines have been functional all the time 4. Not applicable	
sanitation interventions: quality of services, operation and maintenance			
G01.	How often are the toilet facilities cleaned?	1. Twice per day or whenever needed 2. Once per day 3. 2–4 days per week 4. Once per week 5. Less than once per week 6. Not applicable	
B01.	Who is responsible for solid waste management?	1. External provider 2. School management 3. Both external provider and school management 4. School caretakers	Collection and storage at the premise Disposal
G02.	How is solid waste from the school disposed of?	1. Not disposed of by the school but collected by municipal waste system 2. Buried and covered on premises	

		3. Burned on premises at controlled temperatures 4. Openly burned on premises 5. Openly dumped on premises	
G03.	Are sanitary bins for the disposal of used menstrual hygiene products provided in girls' toilet cubicles?	1. Yes 2. No 3. Not applicable	
G04.	In your opinion, what is needed to improve toilet facilities in the school?	1. Increase the number of usable toilets for pupils 2. Improve accessibility, taking into consideration age, gender and limited mobility/vision of pupils 3. Increase privacy and/or safety of toilet facilities 4. Improve cleanliness 5. Ensure regular supply of culturally appropriate means for anal cleansing and/or menstrual hygiene materials 6. Improve waste (solid and/or menstrual) disposal mechanisms 7. Increase budget allocations for operation and maintenance and/or regular consumables provision (e.g., soap) 8. Increase awareness of adequate use and ownership among pupils 9. Other (please specify): _____	
C3. Hygiene Interventions and Menstrual Hygiene Management: Availability and Functionality			

H01.	Is water usually available for hand washing?	1. Yes, always (or at all times throughout the school year) 2. Most of the time 3. Rarely 4. No, never 5. Not applicable	
H02.	Are hands washing facilities accessible to all pupils in the school?	1. Yes, hand washing facilities are accessible to all pupils 2. No 3. Not applicable	
H03.	If hand washing facilities are not accessible to all pupils, what are the reasons?	1. Hand washing facilities are not accessible to the smallest children at the school 2. Hand washing facilities are not accessible to pupils with limited mobility 3. Other (please specify):	
H04.	How often are checks made during the day to ensure that toilet facilities remain clean and that soap, drying facilities and anal cleansing materials are provided?	1. Twice or more per day 2. Once per day 3. Less than once per day 4. Such checks are not conducted regularly 5. Not applicable	
H05.	Who is responsible for cleaning of the toilet facilities?	1. Janitors 2. Contracted cleaning services 3. Municipal cleaning services 4. Students 5. Parents 6. QH9.6 Other (please specify):_____	
Hygiene And Menstrual Hygiene Management: Quality of Services, Operation and Maintenance			
I01.	Have cleaning staff/pupils been trained on cleaning procedures, safe	1. Yes 2. No 3. I don't know	

	and adequate use of cleaning materials and protective equipment?		
I02.	What is included in the routine cleaning procedure?	1. Door handles 2. Flush handles 3. Taps 4. Toilet seats 5. Toilet bowls and urinals 6. Shower tray and surrounds 7. Shower heads 8. Hand washing basins/sinks 9. Cubicles (wall, floor, ceiling, lighting, window) 10. Bins (emptying) 11. Are separate cleaning cloths used for different sanitary fixtures and different surfaces?	
I03.	Are separate cleaning cloths used for different sanitary fixtures and different surfaces?	Yes No	
I04.	What cleaning materials are available at the school in case of need?	1. Bucket(s) 2. Mop(s) 3. Gloves 4. Multiple cleaning cloths 5. Detergent	
J01.	Are there any misconceptions or taboos around menstruation that you are aware of?	1. Yes 2. No 3. I do not know 4. No answer	
J02.	What provisions for girls' MHM are available at the school?	1. Private space for girls to manage menstrual hygiene 2. Free menstrual hygiene products (e.g., pads) 3. Sanitary bins for safe disposal of used	

		menstrual hygiene products 4. MHM education 5. MHM information materials 6. Other (please specify):_____ _	
J03.	If there is MHM education at the school, at what age and grade do girls start receiving this information?	Age_____ Grade_____	
J04.	Are teachers in this school trained on menstrual health and hygiene promotion/education?	1. Yes 2. No 3. I don't know	
J05.	Are MHM-related education materials accessible to girls at the school?	1. Yes 2. No 3. There are no MHM-related education materials at the school 4. I don't know	
J06.	When can girls access menstrual hygiene products at the school?	1. Any time, inside the toilet/other facilities 2. Any time, upon request 3. In exceptional cases only 4. No menstrual hygiene materials available	
J07.	Are you aware of girls missing classes because of menstruation?	1. Yes, it is a common phenomenon 2. Yes, but it happens rarely ¨ Girls don't miss classes because of menstruation 3. I don't know	
J08.	In your opinion, what could the school do to make it easier for girls to attend school during menstruation?	1. Provide access to information and MHM education 2. Improve sanitation facilities (privacy, accessibility, cleanliness)	

		3. Improve access to menstrual hygiene materials 4. Provide social support for school girls (overcoming MHM associated stigma and marginalization) 5. More effective disposal of menstrual waste 6. Other (please specify):_____	
Q 3: What are the outcomes of WASH interventions in public primary schools in Uasin Gishu County			
SECTION D: OUTCOMES OF SCHOOL WASH INTERVENTIONS			
Q1. OT	What activities are undertaken for hygiene promotion at the school?	1. Hygiene education included in the curriculum 2. Extracurricular activities on hand washing 3. Group hand washing activities 4. Educational/informative materials made available 5. Reminders and posters hanged at critical points 6. Teachers are requested to remind pupils to wash their hands 7. Teachers have regular training Other ((please specify):_____	
Q2. OT	How many times per week are group hands washing activities conducted for all pupils?	1. At least once per school day 2. 2–4 days per week 3. Once per week 4. Less than once per week 8. Not applicable	

Q4. OT	Are records for the cleaning schedule of the toilet facilities available?	1. Yes 2. No 3. Not applicable		
Q6. OT	Are there active hygiene promotion activities in the school	Yes	No	
Q.7OT	Are there reports of training of teachers and other school staff on MHM	Yes	No	
Q14.OT	Is there a record for cleaning of school compound or environment?	Yes	No	
Q15.OT	Are school yard, compound and classrooms clean?	Yes	No	
Q16.OT	Where are discussions on WASH with pupils in schools conducted?	● Class ● Assembly ● Both class and assembly ● Any other- specify ● Not applicable		
Q17.OT	How often are school discussion on hygiene with pupils in school held?	● Daily ● Weekly ● Monthly ● Quarterly ● Yearly		
Q18. OT	Is sanitation and hygiene education incorporated in the curriculum at all levels?	Yes	No	

Appendix II: Observation Checklist of school WASH facilities

	QUESTION	RESPONSES	SKIP LOGIC
	SECTION A: GENERAL INFORMATION OF THE PRIMARY SCHOOL		
GI 01	Date of the inspection	(dd/mm/yy):	
GI02	Time of the inspection	(hh/mm):	
GI03	School identification number		
GI04	Which sub-county is the school situated		
GI05	School location (GPS)		
GI06	What type of area is the school located in?	1. Rural 2. Urban	

	OBSERVATION CHECKLIST: STATUS OF WASH FACILITIES IN SCHOOLS			
	SCHOOL WASH ACTITIVIES			
A	**Water interventions**			
1	What is the source of water in the school Can you show me the drinking water source?	Connected to existing Piped water scheme Bore hole connected to a pipe Protected dug well Unprotected spring Tanker-truck Surface water Rain water harvesting No water available		
	How many drinking-water points are at the school?	Insert total number: _____ Insert number of functional water points: _____		
2	Is the drinking water source protected?	Yes	No	
3	Is there a tap?	Yes	No	
4	If there is a tap, does water flow out of the tap?	Yes	No	
5	If there is a tap, does the tap leak	Yes	No	

6	Which type of water storage contained is available in the school	Plastic storage water tank Masonry storage water tank Portable water container Aluminum water tank		
A	Is the cup/ladle/dipper kept clean, off the floor and out of reach of students?	Yes	No	
B	Is the drinking water storage container covered?	Yes	No	
C	Does the drinking water storage container look clean?	Yes	No	
E	Are any of the following treatment equipment or supplies observed?	**Multiple Response-Select all that apply** Bleach/ Chlorination Piece of Cloth Water Filtering device Other filter (Ceramic, Sand, Composite) Other (Specify)		
7	If there are students with a disability or special needs, do they face any of the following barriers to getting drinking water without assistance?	**Multiple Response-Select all that apply** Distance to source Difficult terrain Lack of access features such as ramps Pump handles are hard to use Difficulty carrying or transporting container N/A Other (Specify)		
8	Do the youngest students face any of the following barriers to getting drinking water without assistance?	**Multiple Response-Select all that apply** Distance to source Difficult terrain Lack of access features such as ramps Pump handles are hard to use Difficulty carrying or transporting container Other (Specify)		
9	Does the school dispose of used water?	Yes	No	
A	What are the points of discharge of school's used water?	**Observe and Record: Take a picture.** **Multiple Response-Select all that apply** ☐ Piped sewer ☐ Piped, don't know where ☐ Soak away/Cesspit/Septic system ☐ Sanitation facility ☐ Open channel ☐ Street surface		

		☐ Street ditch/gutter ☐ Space outside premises ☐ Water body (lake, river) etc. ☐ Premises yard or garden ☐ Other (Specify)	
B	Other observations about points of discharge of used water	**Observe and Record:** **Take a picture** **Multiple Response-Select all that apply** Stagnant water pool Swampy area Lots of insects/ Mosquito breeding Bad smell Signs of residues (soap, green slime) Other (Specify) None	
B	**Sanitation interventions**		
11	What type of sanitary facilities exist? Select all that apply and record number of each type of facility	**Flush/Pour flush** Flush to piped sewer system Flush to septic tank Flush to pit latrine Flush to somewhere else Flush to unknown place/Not sure **PIT LATRINE** Ventilated Pit Latrine Pit Latrine with slab Pit latrine without slab/Open pit Composting toilet Bucket Hanging toilet/Latrine No Facility/Bush/Field Other (Specify)	

	Where are the pupils' toilet facilities located?	☐ Within the school building on each floor ☐ Within the school building but not on each floor ☐ Outside the school building, but on the premises ☐ Off the premises ☐ Some within the school building and some outside the building ☐ ¨ Not applicable		
	Are there separate toilets for boys and girls?	Yes	No	
	How many toilets are there for boys	2-4 5-7 8-10 11-13 Above		
	How many toilets are there for girls	2-4 5-7 8-10 11-13 Above 13		
12	What are the conditions of these facilities? Select One	☐ Fully functioning ☐ Partially functioning ☐ Not Functioning		
	Is lighting in the toilet facilities adequate and functional?	☐ All toilets have functional lighting ☐ Half or more of the toilets have functional lighting ☐ Very few or none of the toilets have functional lighting ☐ Not applicable		
13	Do the students toilets/latrines provide privacy?	Yes	No	

A	Do you observe any of the following?	**Multiple Response-Select all that apply** Closable doors that lock from inside Holes or cracks Windows or low walls	
14	Do you observe any of the following adaptations for students with disabilities/special needs?	**Multiple Response-Select all that apply** Widened entrance Widened space for toilet facility Adapted door handles or closing mechanism Built a ramp or sloping path Installed hand rails or grab bars Changed latrine design Use movable or adapted toilet seat Changed flooring material Other (Specify)	
15	Do you observe any of the following adaptations for the youngest students?	Smaller toilet hole Lower seat Lower door handles Other (Specify)	
F	What is the main material of the walls of the latrine?	**Natural walls** Mud and sticks Cane/Palm/Trunks Straw, thatch mats **Rudimentary walls** Mud bricks Plywood, re-used wood Cardboard, plastic **Finished Walls** Cement/Stone blocks Bricks Wood planks/Shingles Other (Specify)	

16	What type of flooring is there in the latrine?	earth / sand / mud wood planks brick ceramic tiles concrete other (specify)			
17	What type of roof does the latrine have?	thatch mats wood planks tarpaulin, plastic cloth zinc, metal, tin wood ceramic tiles concrete, cement asbestos sheets, shingles stone no roof other (specify)			
18	What is the latrine door made of?	metal sheet mats cloth curtain wood no door other (specify)			
19	Does the latrine have a lid cover?	Yes	No		
20	Is the latrine pan broken, chocked, blocked due to debris, stone, leaves, mud, paper, etc.?	Yes	No		
21	Does the latrine have a ventilation pipe?	Yes	No		
22	Is the outer tip of the ventilation pipe covered with a wire net or any material that has	Yes	No	Don't Know	

	perforation/small holes that will prevent flies from entering/leaving the pit?				
23	Is there a water storage container or tank in the latrine for anal cleansing or flushing?	Yes	No	N/A	
24	Is the pit or septic tank covered?	☐ Not covered ☐ Properly covered ☐ Cover doesn't fit well ☐ Direct pit latrine, doesn't need cover ☐ don't know ☐ does not have pit or septic tank			
	Ways of promotion of menstrual hygiene management among girls in schools	☐ Sensitize all learners and members of the school ☐ community on menstruation and its management ☐ Provide menstrual hygiene products to all girls in ☐ Provision of bath rooms, ☐ Availability of changing rooms ☐ Availability of sanitary bins, ☐ Availability of disposal facilities in schools			
C	**Handwashing with Soap**				
25	Is there a place to wash hands?	Yes	No		
	If yes above how many handwashing facilities are at the school?	☐ Total number of handwashing facilities ☐ Number that are functional ☐ Number of functional facilities with soap			
26	What type of handwashing facilities exist? Select all that apply and number of each type	☐ Running water from a piped system or tank ☐ Hand-poured water system ☐ Bucket with a dipper and basin (handwashing done in the basin ☐ Plastic container with tap ☐ Plastic container without tap ☐ None ☐ Other (Specify)			
28	Is there soap for hand washing	Yes	No		
	Are cleaning materials available e.g. detergent and brush	Yes	No		

	Are hand washing facilities are accessible to pupils with limited mobility	☐ Yes ☐ No ☐ N/A			
29	What are the conditions of the washing facilities	Fully functioning	Partially functioning	Not Functioning	
	If handwashing facilities are not functional, what are the reasons?	☐ No water ☐ Broken/missing faucet ☐ Broken basin ☐ Clogged sinks ☐ No drainage in place ☐ Other (please specify): _____	Yes yes yes Yes Yes	No No No No No	N/A N/A N/A N/A N/A
	Where are handwashing facilities located?	☐ Near the toilets ☐ In food preparation area ☐ In food consumption areas ☐ In classrooms ☐ In school yard ☐ Other (please specify): _____	Yes Yes Yes Yes Yes Yes	No No No No No No	N/A N/A N/A N/A N/A N/A
30	Do you observe any of the following? Select all that apply	☐ Clear path with no obstructions, steps or stairs ☐ Tap and soap are reachable from seated position ☐ Tap can be operated by feet and/or closed fist with minimal effort ☐ Height of tap and soap are appropriate for youngest students			
	Is the hand washing facility clean and well drained?		**Yes**	**No**	
A	**Observe- Students WASH Practices**				

1	Do the pupils WASH hands after visiting the toilet?	Yes	No		
3	Did you observe pupils using the toilet	Yes	No		
4	Did the pupils properly use the toilets?	No faces on the floor	Yes	No	
		No urine on the floor	Yes	No	
5	Did the pupils draw water from the safe water container?	Yes	No		
6	Do the pupils crowd at the drinking water source?	Yes	No		
B	**Operations and Maintenance facilities**				
1	Are there posters on WASH messages on walls of the school	Yes	No		
2	Are there visible active hygiene promotion activities in the school	Yes	No		
3	Does the school have documentation of maintenance of WASH facilities	Yes	No		
4	Do the toilets have a bad smell	Yes	No		
5	In general, how clean are the pupils' toilets facilities?	☐ All or more than half of the facilities are clean ☐ All or more than half of the facilities are somewhat clean ☐ All or more than half of the facilities are not clean ☐ Not applicable			
6	Are there cleaning materials for the toilets?	Yes	No		
7	Any visible fecal residues on floor, wall or door	Yes	No		
8	Any visible used anal cleansing material (e.g. toilet paper)	Yes	No		
9	Any visible surface flow or sewage	Yes	No		

10	Is there a solid waste management facility within the school	☐ Yes	No	
	Are there any records of cleaning and maintenance schedule?	☐ Yes, satisfactory ☐ Yes, but incomplete or outdated ☐ No		
12	Is there a record for cleaning of school compound or environment?	☐ Yes, satisfactory. ☐ Yes, but incomplete or outdated. ☐ No		
13	Are school yard, compound and classrooms clean?	Yes	No	
14	Are records available for tracking performance of regular maintenance of the water points?	☐ Yes, satisfactory ☐ Yes, but incomplete or outdated ☐ No		N/A

Food hygiene and sanitation			
CH18.	Does the school have a kitchen or cooking area?	Yes No	
Describe the working area			
CH19.	Is the kitchen supplied with the tap running water	1. Yes 2. No	
CH20.	Floor	1. Washable 2. Partially washable 3. Not washable	
CH21.	Work tops	1. Washable 2. Partially washable 3. Not washable	
CH22.	Does the kitchen have a food store	1. Yes 2. No	
CH23.	Is the food store fitted with cabinets or raise timber	1. Yes 2. No	
CH24.	How many employees work in the kitchen	…….	

CH25.	How many of the employees have valid food handler medical certificate (with 6 months)	……	

Appendix III: Focused Group Discussion interview to teachers.

School Water, Sanitation and Hygiene	
Questions	**Responses option(s)**
General information	
Interview Date	
Interviewer Identification	
Location	
Record GPS	
School identification No.	
Teacher information	
Gender	1. Male 2. Female
Age	
Any other role in the school?	
Highest Level of Education attained	1. Primary 2. Secondary 3. Certificate 4. Diploma 5. Degree 6. Masters Other please specify
Category of classes taught	1.Pre-primary 2.Primary 3.Junior secondary

Interview guide for focused group discussion

1. What is your understanding school health program?
2. Tell me about Water Sanitation and Hygiene activities in schools?
3. What are the activities related to WASH that are being implemented in your school?
4. How has WASH been implemented in your school?
5. What is your role as a teacher in implementation of WASH program in your school
    a. What is your opinion on the role of a teacher in WASH program
6. What resource are allocated for WASH in your schools and how do they get allocated?
7. What observations can you make concerning WASH activities in your school?
8. What support have you received in implementing WASH activities in your school?
9. What is your opinion about availability and quality of water for drinking and other uses in your school for both pupils and school staff?
10. What is your opinion on adequacy and quality of sanitation facilities in your schools which includes; refuse disposal, school compound cleanliness, toilets use and cleaning
11. Can you comment about hygiene and menstrual management in your school?
12. In your opinion, to what extent access to the school WASH facilities is limited for children with disabilities? Please explain.
13. Can you comment about food safety in your school; preparation, storage and food handing
14. What is your take on school children education and participation in WASH activities in your school?
15. Who is responsible for operation and maintenance of your sanitation facilities?

16. What challenges have you experienced in implementing WASH activities in your school?
17. How can implementation of WASH activities be improved in your schools?

Appendix IV: Key Informant Interview Guide: School Head Teachers

WASH policy and implementation

1. What is your role and responsibilities in the implementation of WASH program in the school
2. How does your school implement school WASH policy guidelines?
3. What aspects of WASH as outlined in the school health policy guidelines are implemented in your school?
4. Who is involved in the implementation of School WASH policy guidelines in your school?
5. What is your opinion on implementation of WASH policy guidelines in your school?
6. Can you comment on teachers training on Water, Sanitation and Hygiene in your school?
7. In your opinion, is the educational material easily applicable for students in their daily life both at school and outside of it? Please explain.
8. What interventions do you have in place to promote and strengthen WASH in your school?

Coordination of WASH activities

9. What is your role as the head teacher in coordinating WASH program activities in your primary school?
10. What is the role of the Board of Management in your school WASH program?
11. Who else in engaged in provision of WASH program activities in your school?
12. What is your opinion on effectiveness of school WASH program with involvement of all the members as indicated in the WASH program guidelines

Funding and Budgeting of WASH program in school

13. Can you comment about funding of school WASH, what is your take on this?
14. Do you get government capitation for school WASH activities and what is your take on this?
15. What comments can you make concerning resources allocation, operation and maintenance of WASH facilities in your school?

Monitoring and reporting

16. Does the school have its internal monitoring mechanisms of WASH program activities? Please explain the activities
17. Does the school have WASH surveillance and monitoring by the government or by any other stakeholders, if yes tell us more about it?

Cleaning and maintenance of the WASH facilities

18. What are the management systems in place to keep the WASH facilities in proper working and hygienic order? Please explain
    a. In your opinion, could these management systems be improved? → If yes, in which ways? → If no, what works with the current management practices?

Water provision

19. What can you say about adequacy of water for drinking and other uses in your school?
    a. In your opinion, is the amount of drinking water provided sufficient to meet students/teaching personal daily needs? Please explain.

b. Is the amount of water provided to the school for hygiene practices (washing hands, cleaning etc.) sufficient? Please explain.

20. Is there a need for improvement of Water facilities in your schools and which ones?

Hygiene and menstrual hygiene management

21. How do you promote hygiene among learners and teachers in your school?

22. Do you consider that the number of hygiene-related products (soap, water jugs, etc.) provided to teachers and students is adequate?
    a In your experience, how often does the school WASH facilities run out of hygiene-related material?
    b What can these shortages (if any) be attributed to? Please explain.
    c How could these shortages (if any) be reduced?
23. How do you promote menstrual hygiene management among girls in your school?
24. How effective is the incorporation of personal and environmental hygiene education in the school curriculum at all levels?

Sanitation facilities

25. What can you say about the adequacy and quality of sanitation facilities in your school?

26. How do you maintain your school's sanitation facilities?

27. In your opinion, what is needed to improve sanitation facilities in the school?

Learners with special needs and disability

28. In your opinion, to what extent access to the school WASH facilities is limited for children with disabilities? Please explain.
    a. What kind of issues do children with disabilities face in accessing and using school WASH facilities?
    b. How could schools' facilities be improved to facilitate their use by children with disabilities?
29. In your opinion, to what extent is WASH facility access hindering children with disabilities school attendance?

Pupils school WASH practices

30. In your opinion, to what extent are students encouraged to apply what they learn during sanitation and hygiene classes at the school?
    a. To what extent are pupils encouraged to have hygienic practices? (*Prompt: Regular reminder of teacher of basic good hygienic behavior, peer-to-peer teaching, safe water clubs for WASH practices etc.)*
    b. What kinds of hygiene practices do pupils have to comply with at school? (*Prompt: Wash hands before eating and after urinating with soap etc.*)

Conclusion

31. What can the County Government and the central government do to improve on access to WASH in primary schools?

Do you have any comment for us?

Appendix V: Key Informant Interview Guide: WASH experts

DELPHI ROUND ONE

Objective number 3: To develop an appropriate intervention for WASH in public primary schools in Uasin Gishu County, Kenya.

The County Educational officer, the schools' Boards of Management (BOM), the county in-charge of water department, the county director of health, the county public works officer, the Kenya Institute of Curriculum Development officer, and representatives of non-governmental organizations participating in WASH activities in Uasin Gishu County.

Background information

1. Tell me about yourself?
    - What are your roles and responsibilities
    - How long have you worked as an officer participating in school WASH in Uasin Gishu county (Number of months/years)

General Introduction of WASH program.

2. What is your understanding of Water Sanitation and Hygiene program in schools

4. How does Uasin Gishu County implement school WASH program?

5. What aspects of WASH are implemented in public primary school in Uasin Gishu County?

6. How do you participate or what is your role in school WASH program activities in Uasin Gishu County?

7. Who are the key stakeholders involved in the implementation of School WASH program in Uasin Gishu County?

8. What is your opinion on implementation of WASH activities/program in school Uasin Gishu County?

County government support

1. In your opinion, what are the underlying causes of health issues among school going children in Uasin Gishu County? [WASH related]
2. How does the County/Sub-County support WASH activities in primary schools in Uasin Gishu County?
3. In your opinion, is the current School WASH program well enforced?
4. Which components of WASH program have been captured in the Uasin Gishu County integrated development plan ?

Funding and budgeting

5. Who funds WASH program activities in primary schools in Uasin Gishu County? what is your opinion on this?
6. What are the major challenges that hinder access to WASH in primary schools in Uasin Gishu?
7. What initiatives have been put by the county and other stakeholders to address the challenges mentioned?
8. What future plans does the county and other stakeholders have to ensure improved access to WASH in schools?

Coordination of School WASH activities

9. Who are stakeholders involved in coordination of school WASH program in the county?
10. How effective is the School WASH program being coordinated by the county and various stakeholders?

Operation and maintenance (public works and Water)

11. What is your role in operation and maintenance of school WASH facilities in Uasin Gishu County?
12. What is your role in quality assurance and maintenance of standards of school WASH in Uasin Gishu County?

Monitoring and evaluation of School WASH facilities

13. What are the structures in place to monitor and evaluate WASH program in school by the county government?
    - Kindly explain how you monitor functionality of School WASH facilities in Uasin Gishu County?
14. How effective are the structures in place in monitoring and evaluation of WASH program in schools in Uasin Gishu County?

Provision of safe and clean water in schools?

15. What is your role in provision of safe and clean water in primary schools in Uasin Gishu
16. In your opinion, how effective are you in provision of safe and clean water in schools?

Provision of adequate and quality sanitation facilities in schools

17. In your opinion, what is needed to improve toilet facilities in the school?
18. What are your roles in ensuring that all schools have adequate sanitation facilities?

Provision of hygiene and menstrual Hygiene management facilities in schools

19. What is your role in provision of hand washing facilities in primary schools in Uasin Gishu County?
20. What is your opinion on availability of hand washing facilities in primary schools Uasin Gishu County?
21. What is your opinion on effectiveness of hand washing facilities in primary schools Uasin Gishu County?
22. What are some of the hygiene promotion activities in the school Uasin Gishu County?
23. What initiatives are in place to promote menstruation Health management in school in Uasin Gishu?
    a. In your opinion, can you say that you have met the expected standards according to what is laid down in the WASH guideline? Please explain

Food safety

24. How do you ensure quality and safe food provision to staff and school children in schools in Uasin Gishu County?

What is your opinion on?

1) Who should be involved in the implementation of WASH program in primary schools in Uasin Gishu County?

2) What should be included in the WASH policy guidelines in primary schools in Uasin Gishu County?
3) How should the WASH policy guidelines be implemented in primary schools in Uasin Gishu County?

Appendix VI: structured questionnaire for Delphi techniques round 2

The aim of this round is to give feedback to the experts, allow them to validate their responses to Round one, indicate their level of agreement or disagreement and re-rank their initial scores.

The role of head teacher in WASH policy implementation in schools	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Ensure adequate sanitation facilities in school					
Ensure availability of adequate handwashing facilities					
Ensure constant supply of water in the school					
Ensure proper treatment of water before use					
Ensure proper utilization of water					
Help improve and ensure maintenance of the available WASH infrastructure					
Supervision of staff to ensure clean environment and sanitation facilities					

Who should be involved in the implementation of WASH program in primary schools in Uasin Gishu County?

Opinion on personnel to be involved in implementation of WASH in schools	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
For WASH in schools to be a success there has to be collaboration among different stakeholders including the school board, County and health coordinator					
Community Health Extension Worker (CHEW) needs to be involved in school WASH					

Reproductive health nurse needs to be involved in school WASH					
The government to involve public and private primary schools in WASH program					

What interventions should be included to promote and strengthen WASH policy guidelines in primary schools in Uasin Gishu County?

Interventions to promote and strengthen WASH in the school	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Need for separate budget and funding for WASH in schools					
Increase budgetary allocation to school WASH					
The governments to fund school WASH programs					
Inclusion of multiple stakeholders on school WASH program					
Outsourcing the maintenance of WASH facilities in schools					
Employment of additional quality assurance and standards officers and public health officers for effective school inspection					
Increase frequency of school inspection visits					
Addition of WASH content to school curriculum					
Need for partner support in implementation of the WASH program in schools					
Newly established schools should be integrated schools -have friendly facilities for children with disabilities					
Water interventions					

Water analysis - routine testing of the quality of drinking water sources; periodic pathogenic microorganisms, metals					
All schools to have sunken boreholes and water storage tanks					
Government to provide water to both public and private schools within the municipality					
Interventions on hygiene promotion among learners and teachers in the school					
Learners taken through the practical sessions on how to promote WASH activities e.g. group hand washing station					
Introduction of Health clubs and talking messages on WASH in schools					
There is need for Peer education on WASH in schools					
Commemoration of important WASH days; world hand washing day, world toilet day					
Outreach and sensitization activities in schools					
Access to education material on WASH for students both in schools and outside					
Menstrual health management					
Changing rooms for girls during menstruation be constructed in every school					
All schools should have menstrual waste disposal bins					
Services for collection and disposal of sanitary towels be out sourced					
Government to ensure availability and adequate supply of sanitary towels for menstrual hygiene in schools					
Observe world menstrual day					
Access to the school WASH facilities by learners with disabilities					

All newly established schools to have ramp to easy movement of learners with disabilities					
All newly established schools to have Sanitation facilities appropriate for learners with disabilities					
Taps height consideration and models of opening and closing the taps to be accommodative to learners with disabilities					
Sanitation facilities in schools					
All schools should have flush toilets connected to septic tank for emptying when needed or the sewerage system					
Schools to have staff employed specifically to ensure cleanliness of the sanitation facilities and school environment					

How should the WASH policy guidelines be implemented in primary schools in Uasin Gishu County?

Interventions on how to implement WASH policy guidelines in schools	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
There is need for follow-up of funded facilities in schools to ensure completion and functionality					
Best performing schools on WASH should be recognized and awarded					
Government to engage both private and public schools stakeholders on WASH program					
Head teachers and teachers need capacity building on WASH program in schools					
Head teacher to appoint teachers or departments to coordinate school WASH					

Do you have any questions for us?

Appendix VII: Letter of information to head teachers/ personnel in charge of WASH to answer the structured questionnaire

Title of the Resea  ne Interventions towards effective response u, Kenya

Researcher: Gladys Chepkorir Seroney Mooka- MSc Nursing

Supervisors: Prof. Gugu Gladness Mchunu- PhD
Prof. Gideon Ngwena Magak-PhD

Brief Introduction: Water, sanitation and hygiene have been identified as key determinants of community and public health status in human populations. Schools can be critical places for the control and spread of infectious diseases such as gastrointestinal diseases or respiratory infections, including COVID-19, depending on their access to and quality of WASH.
The purpose of the study is: To develop an appropriate intervention for WASH in primary schools based on an exploration of the current status of WASH intervention in selected primary schools in Uasin Gishu County, Kenya.

Dear Sir/ Madam
Hello,
I am a post graduate student at DUT in the faculty of Health Sciences. I am conducting a research study as part of requirement for a PhD in Health Sciences.

As a head teacher in public and private primary schools in Uasin Gishu County, Kenya, I would like to invite you to participate in this research on the **Evaluation of Water, Sanitation and Hygiene Interventions towards effective response to infectious diseases: A case study of schools in Uasin Gishu, Kenya**

The aim of the study is to conduct an exploration of the current status of Water, Sanitation and Hygiene intervention in selected primary schools in Uasin Gishu County, Kenya and thereafter develop an appropriate intervention

You will be expected to fill a questionnaire and also participate in an interview, the questions are designed to gather information on policy and guidelines in place for executing the WASH program in primary school, planning and coordinating WASH program in schools, financing, budgeting monitoring and evaluation of school WASH program in the county.

Although this study may not benefit you directly, it will provide important information that might be used by the government, non-governmental organizations with designing, implementing, modifying Water Sanitation and Hygiene program in schools in Kenya.

The study procedure involves no feasible risks or harm to you. Your participation in this study is voluntary and you can withdraw from the study any time if you so wish and without any penalty. There will be no monetary gain or receive any other type of remuneration for participating in this research.
All information that you give will be confidential and will only be used for the purpose of this study. At all times the researcher will uphold and respected your rights and dignity. Participating in the study will take approximately 30 - 40 minutes. The outcome of this research study will be published in an academic journal and a copy of the dissertation will be submitted to the Ministry of Education at the County and at the National Government. I will also plan with the Director of Education in Uasin Gishu County for a physical session where I will share the research findings.
The collected data in both soft and hard copy including tape recording will be kept at the DUT University Library for a period of 5 years after publication of the research study findings, thereafter the University will be a liberty to destroy the data according to the University policies on research.

You are free to ask any questions about the study or in case of any problem. You may call me (Ms. Gladys Chepkorir Seroney Mooka) at +254722887548 or email me at 22176505@dut4life.ac.za You may also call my supervisors using the following details
Prof. Gugu Gladness Mchunu- email address gugum6@dut.ac.za
Prof. Gideon Ngwena Magak- email address ngideon@maseno.ac.ke
Other contacts are the DUT-Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Acting Director: Research and Postgraduate Support on researchdirector@dut.ac.za

Appendix VIII: Letter of information to experts for Delphi technique round 1

LETTER OF INFORMATION

Title of the Research Study: An Evaluation of Water, Sanitation and Hygiene Interventions towards effective response to infectious diseases: A case study of schools in Uasin Gishu, Kenya

Researcher: Gladys Chepkorir Seroney Mooka- MSc Nursing

Supervisors: Prof. Gugu Gladness Mchunu- PhD
Prof. Gideon Ngwena Magak-PhD

Brief Introduction: Water, sanitation and hygiene have been identified as key determinants of community and public health status in human populations. Schools can be critical places for the control and spread of infectious diseases such as gastrointestinal diseases or respiratory infections, including COVID-19, depending on their access to and quality of WASH.

The purpose of the study is: To develop an appropriate intervention for WASH in primary schools based on an exploration of the current status of WASH intervention in selected primary schools in Uasin Gishu County, Kenya.

Dear Sir/ Madam
Hello,
I am a post graduate student at DUT in the faculty of Health Sciences. I am conducting a research study as part of requirement for a PhD in Health Sciences.

As a WASH expert in schools in Uasin Gishu County, Kenya, I would like to invite you to participate in this research on the **Evaluation of Water, Sanitation and Hygiene Interventions towards effective response to infectious diseases: A case study of schools in Uasin Gishu, Kenya**

The aim of the study is to conduct an exploration of the current status of Water, Sanitation and Hygiene intervention in selected primary schools in Uasin Gishu County, Kenya and thereafter develop an appropriate intervention.

As an expert you will be interviewed to give your views on ways in which WASH program in schools should be implemented to make it more effective. This is referred to as Delphi round 1. Your view will be analyzed and a structured questionnaire will be developed from the analysis; this will be brought back to you for validation in Delphi technique round 2 to validate your views. The researcher will use an

interview schedule to guide the interview. It will be administered between 10-20 minutes only and your response will be recorded

.

Although this study may not benefit you directly, it will provide important information that might be used by the government, non-governmental organizations with designing, implementing, modifying Water Sanitation and Hygiene program in schools in Kenya.

The study procedure involves no feasible risks or harm to you. Your participation in this study is voluntary and you can withdraw from the study any time if you so wish and without any penalty. There will be no monetary gain or receive any other type of remuneration for participating in this research.

All information that you give will be confidential and will only be used for the purpose of this study. At all times the researcher will uphold and respected your rights and dignity.

The outcome of this research study will be published in an academic journal and a copy of the dissertation will be submitted to the Ministry of Education at the County and at the National Government. I will also plan with the Director of Education in Uasin Gishu County for a physical session where I will share the research findings.

The collected data in both soft and hard copy including tape recording will be kept at the DUT University Library for a period of 5 years after publication of the research study findings, thereafter the University will be a liberty to destroy the data according to the University policies on research.

You are free to ask any questions about the study or in case of any problem. You may call me (Ms. Gladys Chepkorir Seroney Mooka) at +254722887548 or email me at 22176505@dut4life.ac.za You may also call my supervisors using the following details

Prof. Gugu Gladness Mchunu- email address gugum6@dut.ac.za

Prof. Gideon Ngwena Magak- email address ngideon@maseno.ac.ke

Other contacts are the DUT-Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Acting Director: Research and Postgraduate Support on researchdirector@dut.ac.za

Appendix IX: Letter of information to experts for Delphi technique round 2

Title of the Research Study: An Evaluation of Water, Sanitation and Hygiene Interventions towards effective response to infectious diseases: A case study of schools in Uasin Gishu, Kenya

Researcher: Gladys Chepkorir Seroney Mooka- MSc Nursing

Supervisors: Prof. Gugu Gladness Mchunu- PhD
Prof. Gideon Ngwena Magak-PhD

Brief Introduction: Water, sanitation and hygiene have been identified as key determinants of community and public health status in human populations. Schools can be critical places for the control and spread of infectious diseases such as gastrointestinal diseases or respiratory infections, including COVID-19, depending on their access to and quality of WASH.

The purpose of the study is: To develop an appropriate intervention for WASH in primary schools based on an exploration of the current status of WASH intervention in selected primary schools in Uasin Gishu County, Kenya.

Dear Sir/ Madam
Hello,
I am a post graduate student at DUT in the faculty of Health Sciences. I am conducting a research study as part of requirement for a PhD in Health Sciences.

As a WASH expert in schools in Uasin Gishu County, Kenya, I would like to invite you to participate in this research on the **Evaluation of Water, Sanitation and Hygiene Interventions towards effective response to infectious diseases: A case study of schools in Uasin Gishu, Kenya**

The aim of the study is to conduct an exploration of the current status of Water, Sanitation and Hygiene intervention in selected primary schools in Uasin Gishu County, Kenya and thereafter develop an appropriate intervention.

The aim of this round 2 of data collection is to give feedback to you as the experts in WASH, this will allow you to validate the responses to Round one of the Delphi approach, which was structured questionnaire and interview you participated in. You are expected to indicate the level of agreement or disagreement and re-rank your initial scores.
You will be expected to fill a questionnaire, the questions are designed to gather information on yours views to review policy and guidelines in place for executing the WASH program in primary school,

planning and coordinating WASH program in schools, financing, budgeting monitoring and evaluation of school WASH program in the county.
The online interviewer assisted questionnaire will be administered between 8-10 minutes only. There is also a hardcopy of the questionnaire which can be filled.

Although this study may not benefit you directly, it will provide important information that might be used by the government, non-governmental organizations with designing, implementing, modifying Water Sanitation and Hygiene program in schools in Kenya.
The study procedure involves no feasible risks or harm to you. Your participation in this study is voluntary and you can withdraw from the study any time if you so wish and without any penalty. There will be no monetary gain or receive any other type of remuneration for participating in this research.
All information that you give will be confidential and will only be used for the purpose of this study. At all times the researcher will uphold and respected your rights and dignity.

The outcome of this research study will be published in an academic journal and a copy of the dissertation will be submitted to the Ministry of Education at the County and at the National Government. I will also plan with the Director of Education in Uasin Gishu County for a physical session where I will share the research findings.
The collected data in both soft and hard copy including tape recording will be kept at the DUT University Library for a period of 5 years after publication of the research study findings, thereafter the University will be a liberty to destroy the data according to the University policies on research.

You are free to ask any questions about the study or in case of any problem. You may call me (Ms. Gladys Chepkorir Seroney Mooka) at +254722887548 or email me at 22176505@dut4life.ac.za You may also call my supervisors using the following details
Prof. Gugu Gladness Mchunu- email address gugum6@dut.ac.za
Prof. Gideon Ngwena Magak- email address ngideon@maseno.ac.ke
Other contacts are the DUT-Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Acting Director: Research and Postgraduate Support on researchdirector@dut.ac.za

Appendix X: Letter of information to experts on proposed WASH interventions in schools

Title of the Research Study: An Evaluation of Water, Sanitation and Hygiene Interventions towards effective response to infectious diseases: A case study of schools in Uasin Gishu, Kenya

Researcher: Gladys Chepkorir Seroney Mooka- MSc Nursing

Supervisors: Prof. Gugu Gladness Mchunu- PhD
Prof. Gideon Ngwena Magak-PhD

Brief Introduction: Water, sanitation and hygiene have been identified as key determinants of community and public health status in human populations. Schools can be critical places for the control and spread of infectious diseases such as gastrointestinal diseases or respiratory infections, including COVID-19, depending on their access to and quality of WASH.

The purpose of the study is: To develop an appropriate intervention for WASH in primary schools based on an exploration of the current status of WASH intervention in selected primary schools in Uasin Gishu County, Kenya.

Dear Sir/ Madam
Hello,
I am a post graduate student at DUT in the faculty of Health Sciences. I am conducting a research study as part of requirement for a PhD in Health Sciences.

As an expert of WASH (head teacher/ School board member/ officer of the county government of Uasin Gishu) in schools in Uasin Gishu County, Kenya, I would like to invite you to participate in this research on the **Evaluation of Water, Sanitation and Hygiene Interventions towards effective response to infectious diseases: A case study of schools in Uasin Gishu, Kenya**

The aim of the study is to conduct an exploration of the current status of Water, Sanitation and Hygiene intervention in selected primary schools in Uasin Gishu County, Kenya and thereafter develop an appropriate intervention
As an expert of WASH (head teacher/ School board member/ officer of the county government of Uasin Gishu) in schools in Uasin Gishu County, Kenya, you will be expected to participate in the workshop by

giving your views on interventions that will be presented by the researcher. You are participating in this workshop since you were involved in round one and round 2 of Delphi technique of this study. Your view will be recorded, analyzed and presented as part of this research results. The researcher will use an interview schedule shared with you to guide the interview. The workshop will be conducted within 2 ½ hours to 3 hours.

Although this study may not benefit you directly, it will provide important information that might be used by the government, non-governmental organizations with designing, implementing, modifying Water Sanitation and Hygiene program in schools in Kenya.

The study procedure involves no feasible risks or harm to you. Your participation in this study is voluntary and you can withdraw from the study any time if you so wish and without any penalty. There will be no monetary gain or receive any other type of remuneration for participating in this research.

All information that you give will be confidential and will only be used for the purpose of this study. At all times the researcher will uphold and respected your rights and dignity. Participating in the study will take approximately 30 - 40 minutes. The outcome of this research study will be published in an academic journal and a copy of the dissertation will be submitted to the Ministry of Education at the County and at the National Government. I will also plan with the Director of Education in Uasin Gishu County for a physical session where I will share the research findings.

The collected data in both soft and hard copy including tape recording will be kept at the DUT University Library for a period of 5 years after publication of the research study findings, thereafter the University will be a liberty to destroy the data according to the University policies on research.

You are free to ask any questions about the study or in case of any problem. You may call me (Ms. Gladys Chepkorir Seroney Mooka) at +254722887548 or email me at 22176505@dut4life.ac.za You may also call my supervisors using the following details

Prof. Gugu Gladness Mchunu- email address gugum6@dut.ac.za

Prof. Gideon Ngwena Magak- email address ngideon@maseno.ac.ke

Other contacts are the DUT-Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Acting Director: Research and Postgraduate Support on researchdirector@dut.ac.za

Appendix XI: Consent form filled by all participants in the research



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CONSENT FORM

Full Title of the Study: An Evaluation of Water, Sanitation and Hygiene Interventions towards effective response to infectious diseases: A case study of schools in Uasin Gishu, Kenya

Names of Researcher: Gladys Chepkorir Seroney Mooka

Statement of Agreement to Participate in the Research Study:

- ☐ I hereby confirm that I have been informed by the researcher; **Gladys Chepkorir Seroney Mooka** about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: 22176505.
- ☐ I have also received, read and understood the above written information regarding the study.
- ☐ I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- ☐ In view of the requirements of research, I agree that the data collected during this study can be processed in a computerized system by the researcher.
- ☐ I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- ☐ I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- ☐ I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

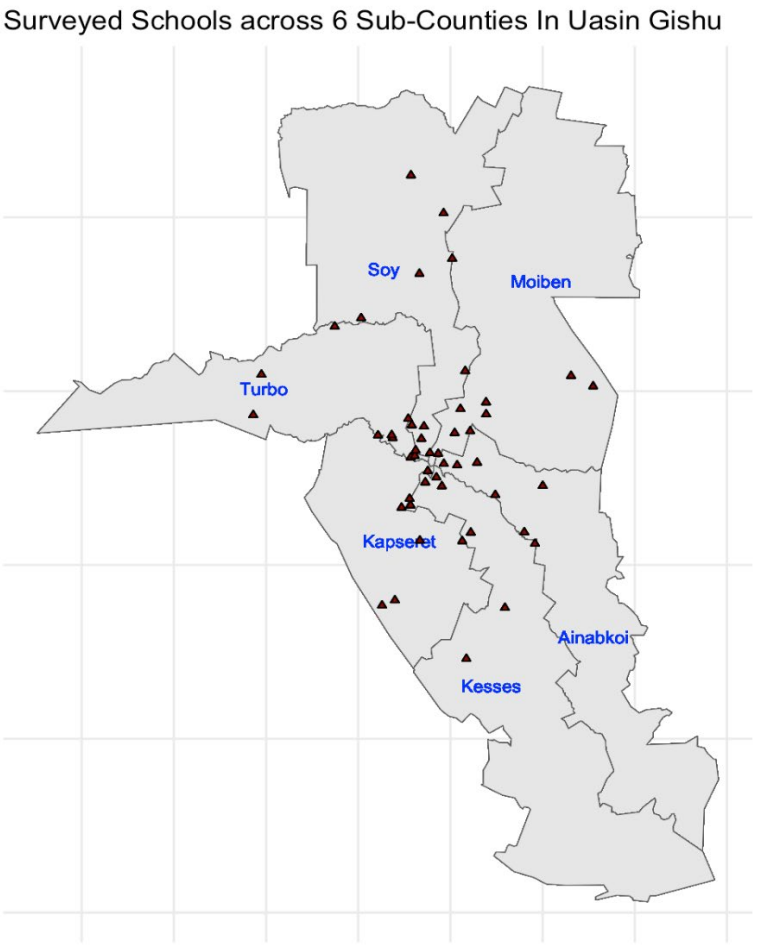
_____	_____	_____	_____
Full Name of Participant	**Date**	**Time**	**Signature**

I, Gladys Chepkorir Seroney Mooka herewith confirm that the above participant has been fully

Informed about the nature, conduct and risks of the above study

_____	_____	_____
Full Name of Researcher	**Date**	**Signature**

Appendix XII: Map of Uasin Gishu County with 6 Sub-Counties included in the study



Appendix XIII: Durban University of Technology IREC approval letter 2025

Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Berwyn Court
Gate 1, Steve Biko Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2375
Email: lavishad@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

28 May 2025

Ms G C S Mooka
Maseno University
Kisumu
Kenya
Private Bag Maseno

Dear Ms Mooka

An Evaluation of Water, Sanitation and Hygiene Interventions towards effective response to infectious diseases: A case study of schools in Uasin Gishu, Kenya
Ethical Clearance number IREC 113/23

The DUT-Institutional Research Ethics Committee acknowledges receipt of your Safety Monitoring and Annual Recertification report.

I am pleased to inform you that the study has been approved to continue.

Please note that ethical approval has been extended till **19 October 2025,** if the research is not complete within this time, you will be required to apply for recertification three months before the expiry date.

Yours Sincerely

_____
Professor P Mashau
Chairperson: DUT-IREC

Appendix XIV: Durban University of Technology IREC approval letter 2024

Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Berwyn Court
Gate 1, Steve Biko Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2375
Email: lavishad@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

18 March 2024

Ms G C S Mooka
Maseno University
Kisumu
Kenya
Private Bag Maseno

Dear Ms Mooka

An Evaluation of Water, Sanitation and Hygiene Interventions towards effective response to infectious diseases: A case study of schools in Uasin Gishu, Kenya
Ethics Clearance Number: IREC 113/23

The DUT-Institutional Research Ethics Committee acknowledges receipt of your final data collection tool for review.

We are pleased to inform you that the data collection tool has been approved. Kindly ensure that participants used for the pilot study are not part of the main study.

In addition, the DUT-IREC acknowledges receipt of your gatekeeper permission letters.

Please note that FULL APPROVAL is granted to your research proposal. You may proceed with data collection.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the DUT-IREC according to the DUT-IREC SOP's.

Please note that any deviations from the approved proposal require the approval of the DUT-IREC as outlined in the DUT-IREC SOP's.

It is compulsory for a student or researcher to apply for recertification on an annual basis. The failure to do so will result in withdrawal of ethics clearance. It is the responsibility of the researcher and the supervisor to apply for recertification.

Please note that you are required to submit a Notification of Completion of Study form together with an abstract to the DUT-IREC office on completion of your study.

Yours Sincerely

Prof J K Adam
Chairperson: DUT-IREC

APPENDIX XV: Kenyan Ethical review committee of University of Eastern Africa, Baraton approval letter 2025

OFFICE OF THE CHAIRPERSON
INSTITUTIONAL SCIENTIFIC ETHICS REVIEW COMMITTEE
UNIVERSITY OF EASTERN AFRICA, BARATON
P.O. BOX 2500-30100, Eldoret, Kenya, East Africa

B109120022025 February 20, 2025

TO: Gladys Chepkorir Seroney Mooka
Faculty of Health Sciences
Durban Unversity of Technology
Kisii University

Dear Gladys,

RE: An Evaluation of Water, Sanitation and Hygiene Interventions Towards Effective Response to Infectious Diseases: A Case Study of Schools in Uasin Gishu, Kenya.

This is to inform you that the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton has reviewed and approved your above research proposal. Your application approval number is UEAB/ISERC/109/02/2025. The approval period is from February 20th, 2025 February 20th, 2026.

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton.
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton within 72 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected the safety or welfare of study participants and others, or affect the integrity of the research must be reported to the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton within 72 hours.
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to the expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology, and Innovation(NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

.

Sincerely yours

University of Eastern Africa, Baraton
20 FEB 2025
P. O. Box 2500-30100, ELDORET
Research Ethics Committee

Prof. Catherine Amimo, PhD
Chairperson, Institutional Scientific Ethics Review Committee

A SEVENTH-DAY ADVENTIST INSTITUTION OF HIGHER LEARNING
CHARTERED 1991

APPENDIX XVI: Kenyan Ethical review committee of University of Eastern Africa, Baraton approval letter 2023

OFFICE OF THE CHAIRPERSON OF THE INSTITUTIONAL SCIENTIFIC ETHICS REVIEW COMMITTEE
UNIVERSITY OF EASTERN AFRICA, BARATON
P.O. BOX 2500-30100, Eldoret, Kenya, East Africa

B4526052023 June 17, 2023

TO: Gladys Chepkorir Seroney Mooka
Faculty of Health Sciences
Durban University of Techonlogy
South Africa.

Dear Gladys,

RE: An Evaluation of Water, Sanitation and Hygiene Interventions Towards Effective Response to Infectious Diseases: A Case Study of Schools in Uasin Gishu, Kenya.

This is to inform you that the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton has reviewed and approved your above research proposal. Your application approval number is UEAB/ISERC/45/05/2023. The approval period is June17th, 2023- June17th, 2024.

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton within 72 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton within 72 hours.
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

Sincerely yours

ientific Ethics Review Committee

University of Eastern Africa, Baraton
17 --- 2023
P. O. Box 2500-30100, ELDORET
Research Ethics Committee

Appendix XVII: Kenyan Research license by National Commission for Science, Technology and Innovation approval, 2025

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **881323**

Date of Issue: **21/July/2025**

RESEARCH LICENSE



This is to Certify that Ms.. GLADYS CHEPKORIR SERONEY MOOKA of Durban University of Technology, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Uasin-Gishu on the topic: An Evaluation of Water, Sanitation and Hygiene Interventions towards effective response to infectious diseases: A case study of schools in Uasin Gishu, Kenya for the period ending : 21/July/2026.

License No: **NACOSTI/P/25/4176029**

881323

Applicant Identification Number

Ag. Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

See overleaf for conditions

THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013 (Rev. 2014)

Legal Notice No. 108: The Science, Technology and Innovation (Research Licensing) Regulations, 2014

The National Commission for Science, Technology and Innovation, hereafter referred to as the Commission, was the established under the Science, Technology and Innovation Act 2013 (Revised 2014) herein after referred to as the Act. The objective of the Commission shall be to regulate and assure quality in the science, technology and innovation sector and advise the Government in matters related thereto.

CONDITIONS OF THE RESEARCH LICENSE

1. The License is granted subject to provisions of the Constitution of Kenya, the Science, Technology and Innovation Act, and other relevant laws, policies and regulations. Accordingly, the licensee shall adhere to such procedures, standards, code of ethics and guidelines as may be prescribed by regulations made under the Act, or prescribed by provisions of International treaties of which Kenya is a signatory to
2. The research and its related activities as well as outcomes shall be beneficial to the country and shall not in any way;
    i. Endanger national security
    ii. Adversely affect the lives of Kenyans
    iii. Be in contravention of Kenya's international obligations including Biological Weapons Convention (BWC), Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), Chemical, Biological, Radiological and Nuclear (CBRN).
    iv. Result in exploitation of intellectual property rights of communities in Kenya
    v. Adversely affect the environment
    vi. Adversely affect the rights of communities
    vii. Endanger public safety and national cohesion
    viii. Plagiarize someone else's work
3. The License is valid for the proposed research, location and specified period.
4. The license any rights thereunder are non-transferable
5. The Commission reserves the right to cancel the research at any time during the research period if in the opinion of the Commission the research is not implemented in conformity with the provisions of the Act or any other written law.
6. The Licensee shall inform the relevant County Director of Education, County Commissioner and County Governor before commencement of the research.
7. Excavation, filming, movement, and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
8. The License does not give authority to transfer research materials.
9. The Commission may monitor and evaluate the licensed research project for the purpose of assessing and evaluating compliance with the conditions of the License.
10. The Licensee shall submit one hard copy, and upload a soft copy of their final report (thesis) onto a platform designated by the Commission within one year of completion of the research.
11. The Commission reserves the right to modify the conditions of the License including cancellation without prior notice.
12. Research, findings and information regarding research systems shall be stored or disseminated, utilized or applied in such a manner as may be prescribed by the Commission from time to time.
13. The Licensee shall disclose to the Commission, the relevant Institutional Scientific and Ethical Review Committee, and the relevant national agencies any inventions and discoveries that are of National strategic importance.
14. The Commission shall have powers to acquire from any person the right in, or to, any scientific innovation, invention or patent of strategic importance to the country.
15. Relevant Institutional Scientific and Ethical Review Committee shall monitor and evaluate the research periodically, and make a report of its findings to the Commission for necessary action.

National Commission for Science, Technology and Innovation(NACOSTI),
Off Waiyaki Way, Upper Kabete,
P. O. Box 30623 - 00100 Nairobi, KENYA
Telephone: 020 4007000, 0713788787, 0735404245
E-mail: dg@nacosti.go.ke
Website: www.nacosti.go.ke

Appendix XVIII: Kenyan Research license by National Commission for Science, Technology and Innovation approval 2023

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **780408**

Date of Issue: **26/October/2023**

RESEARCH LICENSE



This is to Certify that Ms.. GLADYS CHEPKORIR SERONEY MOOKA of Durban University of Technology, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Uasin-Gishu on the topic: An Evaluation of Water, Sanitation and Hygiene Interventions towards effective response to infectious diseases: A case study of schools in Uasin Gishu, Kenya for the period ending : 26/October/2024.

License No: **NACOSTI/P/23/30884**

780408

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

See overleaf for conditions

Appendix XIX: Uasin Gishu County research authorization letter 2023, Ministry of Ministry of Education

REPUBLIC OF KENYA

MINISTRY OF EDUCATION

State Department for Basic Education

Email: cdeuasingishucounty@gmail.com
: cdeuasingishucounty@yahoo.com
When replying please quote:

County Director of Education,
Uasin Gishu County,
P.O. Box 9843-30100,
ELDORET.

Ref: No. MOE/UGC/TRN/9/VOLL. V/47

6th NOVEMBER , 2023

Gladys Chepkorir Seroney Mooka
Durban University of Technology
P.O Box
SOUTH AFRICA.

RE: RESEARCH AUTHORIZATION.

In reference to your License Ref no. **NACOSTI/P/23/30884** dated 26th October ,2023 from National Commission for Science, Technology and Innovation (NACOSTI), you are hereby granted the authority to carry out research on ***"An evaluation of water, Sanitation and Hygiene Interventions towards effective response to infectious diseases: A case study of schools in Kenya" Period Ending 26th OCTOBER 2024,"*** Within Uasin Gishu County.

We take this opportunity to wish you well during this data collection.

FOR: COUNTY DIRECTOR OF EDUCATION
UASIN GISHU COUNTY
06 NOV 2023
P. O. Box 9843 - 30100, ELDORET
TEL: 053-2063342 / 0719127212

Samuel K. Kimaiyo
For: County Director of Education
UASIN GISHU.

Appendix XX: Uasin Gishu County research authorization letter 2025, Ministry of Education

REPUBLIC OF KENYA

OFFICE OF THE PRESIDENT

MINISTRY OF INTERIOR AND NATIONAL ADMINISTRATION

Cell phone: 0726 677 291
E-mail Address: ugcountycommissioner@gmail.com

COUNTY COMMISSIONER'S OFFICE
UASIN GISHU COUNTY
P O Box 30-30100
ELDORET

When replying please quote:

Ref: UG/ADM.15/10 VOL.IV

3rd October, 2025

The Deputy County Commissioners
UASIN GISHU COUNTY

RE: RESEARCH AUTHORIZATION-Ms GLADYS CHEPKORIR SERONEY MOOKA

Reference is made to the Research letter **Ref: 881323 License No: NACOSTI/P/25/4176029** from the National Commission for Science, Technology and Innovation (**NACOSTI**) dated 21st July, 2025.

The above has been granted permission to carry out research on ***"AN EVALUATION OF WATER, SANITATION AND HYGIENE INTERVENTIONS TOWARDS EFFECTIVE RESPONSE TO INFECTIONS DISEASES."*** for the Period ***ending 21st July, 2026.***

Kindly accord her the necessary support.

FOR Dr. Eddyson H Nyale, OGW
County Commissioner
UASIN GISHU COUNTY

Appendix XXI: Nandi County research authorization letter for conducting the pilot study 2024

REPUBLIC OF KENYA
MINISTRY OF EDUCATION
STATE DEPARTMENT FOR BASIC EDUCATION

Email: cdenandicounty@yahoo.com
When replying please quote

Ref: NDI/CDE/RESEARCH/1/VOL.111/109

County Director of Education
NANDI COUNTY,
P. O. Box 36-30300,
KAPSABET.

Date: 9th January, 2024

Gladys Chepkorir Seroney Mooka
Durban University of Technology
P.O Box 1334, Durban 4001
SOUTH AFRICA.

RE: RESEARCH AUTHORIZATION.

Reference is made to the National Commission for Science, Technology and Innovation's letter Ref: No. NACOSTI/P/23/30884 dated 26th October, 2023.

The above named person has been granted permission by the County Director of Education to carry out research on ***"An evaluation of Water, Sanitation and Hygiene Interventions towards effective response to infectious diseases: A case study of schools in Kenya" (A Pilot Study in Nandi County)*** **for the period ending 26th October, 2024.**

Kindly provide her all necessary support she requires.

COUNTY DIRECTOR OF EDUCATION
NANDI COUNTY
P.O. BOX 36-30 100

Harrison
Director of Education,
COUNTY.

Appendix XXII: Uasin Gishu County research authorization letter from the Ministry of interior and national administration 2025

REPUBLIC OF KENYA
OFFICE OF THE PRESIDENT

MINISTRY OF INTERIOR AND NATIONAL ADMINISTRATION

Cell phone: 0726 677 291
E-mail Address: ugcountycommissioner@gmail.com

When replying please quote:

COUNTY COMMISSIONER'S OFFICE
UASIN GISHU COUNTY
P O Box 30-30100
ELDORET

Ref: UG/ADM.15/10 VOL.IV

3rd October, 2025

The Deputy County Commissioners
UASIN GISHU COUNTY

RE: RESEARCH AUTHORIZATION-Ms GLADYS CHEPKORIR SERONEY MOOKA

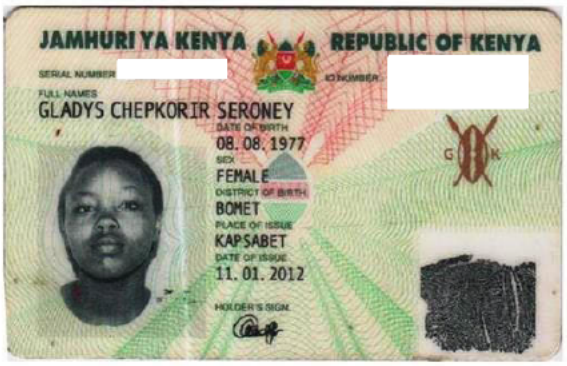
Reference is made to the Research letter **Ref: 881323 License No: NACOSTI/P/25/4176029** from the National Commission for Science, Technology and Innovation (**NACOSTI**) dated 21st July, 2025.

The above has been granted permission to carry out research on ***"AN EVALUATION OF WATER, SANITATION AND HYGIENE INTERVENTIONS TOWARDS EFFECTIVE RESPONSE TO INFECTIONS DISEASES."*** for the Period ***ending 21st July, 2026.***

Kindly accord her the necessary support.

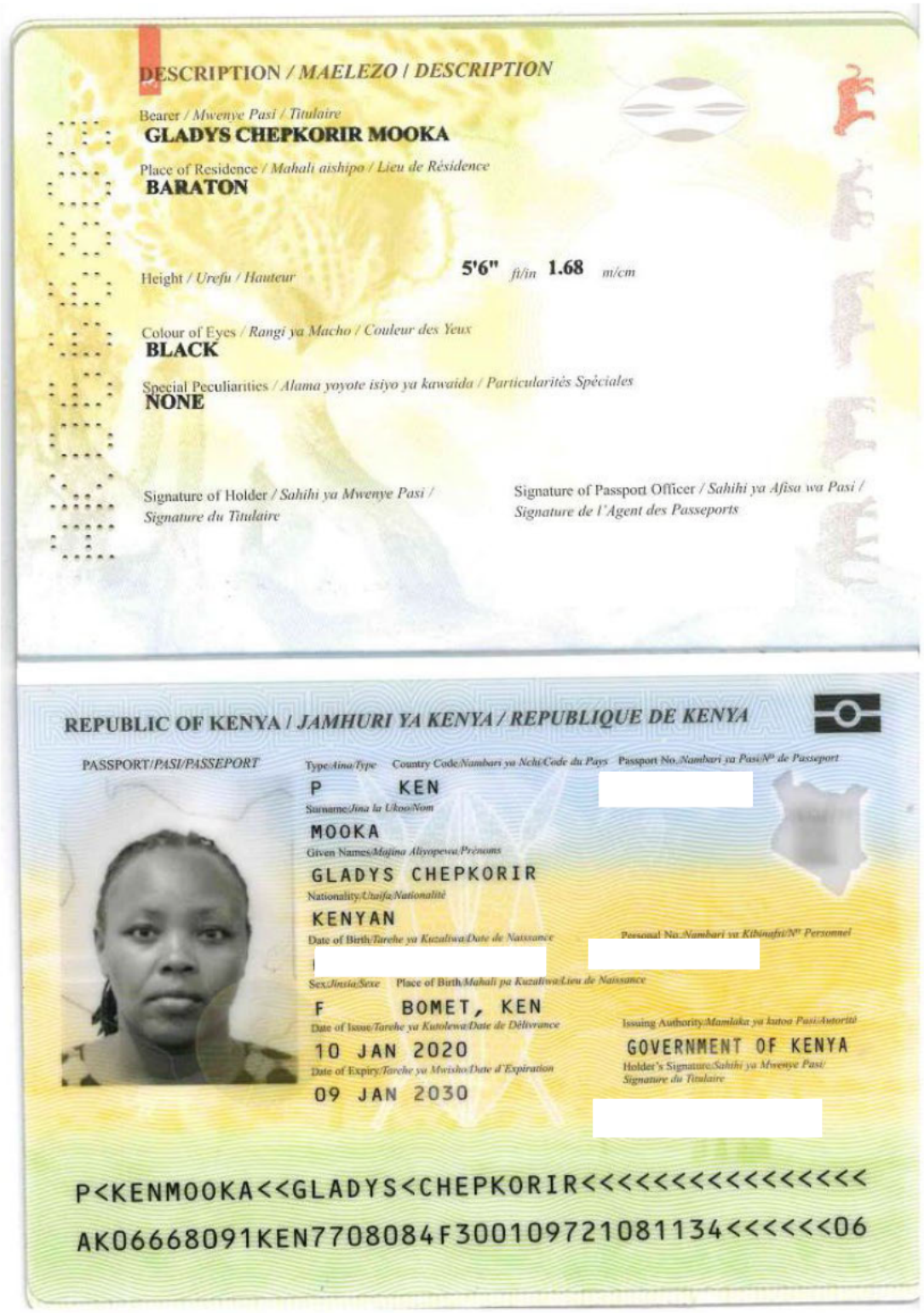
FOR Dr. Eddyson [illegible]
County Commissioner
UASIN GISHU COUNTY

Appendix XXIII: National Identification card





Appendix XXIV: Passport



DESCRIPTION / *MAELEZO / DESCRIPTION*

Bearer / *Mwenye Pasi / Titulaire*
GLADYS CHEPKORIR MOOKA

Place of Residence / *Mahali aishipo / Lieu de Résidence*
BARATON

Height / *Urefu / Hauteur* **5'6"** *ft/in* **1.68** *m/cm*

Colour of Eyes / *Rangi ya Macho / Couleur des Yeux*
BLACK

Special Peculiarities / *Alama yoyote isiyo ya kawaida / Particularités Spéciales*
NONE

Signature of Holder / *Sahihi ya Mwenye Pasi / Signature du Titulaire*

Signature of Passport Officer / *Sahihi ya Afisa wa Pasi / Signature de l'Agent des Passeports*

REPUBLIC OF KENYA / *JAMHURI YA KENYA / REPUBLIQUE DE KENYA*

PASSPORT/*PASI/PASSEPORT*

Type/*Aina/Type* P

Country Code/*Nambari ya Nchi/Code du Pays* KEN

Passport No./*Nambari ya Pasi/N° de Passeport*

Surname/*Jina la Ukoo/Nom*
MOOKA

Given Names/*Majina Aliyopewa/Prénoms*
GLADYS CHEPKORIR

Nationality/*Uraia/Nationalité*
KENYAN

Date of Birth/*Tarehe ya Kuzaliwa/Date de Naissance*

Personal No./*Nambari ya Kibinafsi/N° Personnel*

Sex/*Jinsia/Sexe* F

Place of Birth/*Mahali pa Kuzaliwa/Lieu de Naissance*
BOMET, KEN

Date of Issue/*Tarehe ya Kutolewa/Date de Délivrance*
10 JAN 2020

Issuing Authority/*Mamlaka ya kutoa Pasi/Autorité*
GOVERNMENT OF KENYA

Date of Expiry/*Tarehe ya Mwisho/Date d'Expiration*
09 JAN 2030

Holder's Signature/*Sahihi ya Mwenye Pasi/ Signature du Titulaire*

P<KENMOOKA<<GLADYS<CHEPKORIR<<<<<<<<<<<<<<<<

AK06668091KEN7708084F3001097210811 34<<<<<<06

Appendix XXV: Ethics Training Certificate



TRREE

Zertifikat

Certificat

Certificado

Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Gladys Mooka

a complété avec succès - has successfully completed

Introduction to Research Ethics

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Clinical Trials Centre
The University of Hong Kong

Release Date: 2023/10/12

CID : V27v28PL5b

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

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Programmes de formation postgraduée et continue
Programmes de formation continue
Continuing Education Programms

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[REV : 20220217]