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Technical Factors Associated with Functionality of Hand Washing Practices in Lurambi Sub County, Kakamega County, Kenya

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Abstract

Inadequate handwashing facilities and inconsistent maintenance in Kenyan public primary schools have posed significant health risks, leading to the spread of infectious diseases such as diarrhea and respiratory infections among students. Limited access to reliable water and soap, coupled with insufficient technical maintenance, impedes regular hand hygiene practices, particularly in resource-constrained environments. Moreover, frequent breakdowns and lack of direct water connections to handwashing stations further hinder effective hygiene practices in schools. The purpose of this study was to examine the technical factors influencing the functionality of handwashing practices in public primary schools in Lurambi Sub-County, Kakamega County, Kenya. Anchored by the Socio-Ecological Model (SEM), which considers environmental and institutional influences on behavior, the study employed a cross-sectional survey design. The target population included students and school administrators across public primary schools, with a sample size of 389 respondents selected through cluster sampling and purposive sampling techniques. Data were collected through questionnaires and structured observation, with quantitative data analysed using descriptive statistics in SPSS. Results indicated that while schools had access to various water sources, such as boreholes and shallow wells, the lack of direct piping to handwashing stations and inadequate maintenance led to frequent malfunctions, reducing the consistency of handwashing practices among pupils. Further, reliance on manual water refilling contributed to limited access during class hours, further affecting hygiene compliance. Key informant interviews highlighted the need for infrastructure improvements to enhance water accessibility and functionality. In conclusion, reliable handwashing facilities require both infrastructure investment and regular maintenance to promote consistent hand hygiene practices. It is recommended that schools receive adequate funding to establish direct water connections and improve station durability.

Keywords: *Technical Factors, Functionality, Hand Washing Practices, Lurambi Sub County, Kakamega County, Kenya*

1.0 Introduction

Hand hygiene is universally recognized as one of the most straightforward and effective measures to mitigate infectious diseases; however, practices differ significantly, particularly in underdeveloped areas. Gawai et al. (2016) assert that hand washing with soap is an economical strategy for disease prevention; however, its widespread implementation is hindered by systemic and behavioral obstacles. Berhanu et al. (2022) highlight that essential moments for handwashing, such as post-restroom uses and pre-meal, are frequently neglected, especially in resource-limited environments where soap and water are not reliably accessible. The inconsistency in handwashing practices in developing countries exacerbates the transmission of communicable diseases in crowded environments such as schools, where proximity and inadequate hand hygiene considerably increase the risk of spread. The World Health Organization (WHO) has urged all countries to prioritize hand hygiene by implementing suitable policy measures and enhancing facilities (WHO, 2020). UNICEF (2021b) indicates that in numerous regions, sufficient handwashing facilities are scarce, with many initiatives primarily concentrated on water supply rather than sustainable sanitation and hygiene solutions. Bishoge (2021) advocates for broadening initiatives beyond fundamental water access to encompass affordable hygiene infrastructure, suggesting that enhanced access to handwashing facilities could mitigate health problems and decrease mortality linked to inadequate sanitation. Kumwenda (2019) contends that cost-effective and accessible hygiene measures, such as operational handwashing stations, are crucial for fostering sustained health in educational institutions and communities.

Scholars emphasize the necessity for educational institutions to prioritize access to sanitation and hygiene education to facilitate the adoption of hygiene practices. Osher et al. (2009) and UNICEF (2013) assert that students necessitate access to clean and operational facilities, including handwashing stations furnished with soap and running water, to effectively mitigate transmission risks. Educational institutions equipped with dependable sanitation and hygiene facilities not only mitigate disease transmission but also contribute to the cultivation of enduring habits in students that advantage the broader community (UNICEF, 2012). Enhanced water sources, including piped water and rainwater harvesting systems, markedly improve hygiene adherence by providing accessible and dependable handwashing facilities (WHO & UNICEF JMP, 2018). Resolving technical and functional deficiencies in current handwashing infrastructure is crucial for enhancing usage in educational institutions. Numerous studies demonstrate that dependable, well-maintained handwashing stations are essential for promoting proper hygiene among students. Aiello et al. (2008) discovered that the presence of effective handwashing facilities in community settings reduced the incidence of respiratory and gastrointestinal diseases, illustrating the direct influence of accessible and functional hand hygiene stations on health outcomes. Studies conducted by UNICEF and WHO in Mongolia indicate that access to handwashing facilities, particularly those with reliable water sources and supplies, results in increased usage rates and enhanced hygiene practices. UNICEF, 2016.

1.1 Statement of the Problem

Inadequate handwashing facilities in Kenyan public schools have posed a significant health challenge, leading to the frequent spread of infectious diseases like diarrhea and respiratory infections among students. According to WHO (2020), the lack of reliable access to water and soap in school settings was a primary factor impeding regular hand hygiene in low- and middle-income countries, where sanitation facilities were often either insufficient or poorly maintained. In addition, a study by Wichaidit et al. (2019) reported that in Kenya, only a minority of public schools were equipped with functioning handwashing stations that included both soap and water, limiting the ability of students to adhere to hygiene practices. As a result,

students in these settings were often unable to wash their hands consistently, especially at critical times, heightening their susceptibility to disease transmission and compromising their health and safety in the school environment.

The scarcity of adequate and functional handwashing stations in schools across Kenya has also impacted educational outcomes, as students experiencing frequent illnesses were more likely to miss classes and perform poorly academically. A 2019 survey by the Kenya National Bureau of Statistics (KNBS) and UNICEF revealed that just 40% of Kenyan schools had handwashing facilities with the necessary provisions, and many lacked the resources for regular maintenance or soap supplies (O'Reilly et al., 2021). This gap in hygiene infrastructure directly contributed to irregular handwashing habits, leaving students vulnerable to preventable illnesses and posing a barrier to achieving Sustainable Development Goals (SDGs) related to health, education, and clean water access (UNICEF, 2020).

1.2 Objective of the Study

To examine technical factors associated with functionality of hand washing practices in Lurambi Sub County, Kakamega County, Kenya.

1.3 Research Question

What are the technical factors associated with functionality of hand washing practices in Lurambi Sub County, Kakamega County, Kenya?

2.0 Literature Review

A comprehensive review of theoretical and empirical studies on primary school students' handwashing practices follows. Section 2.1 discusses theoretical issues, choosing a model to understand technical factors affecting handwashing. Section 2.2 analyses handwashing facility functionality, including water availability, infrastructure design, and accessibility. Visualizing the variables and their relationships concludes Section 2.3.

2.1 Theoretical Review

In examining the determinants of handwashing practices among students, the Socio-Ecological Model (SEM) provides a structured approach to analyze various levels of influence, ranging from individual behaviors to larger environmental and institutional factors. Developed by Urie Bronfenbrenner, SEM explores how individual actions are affected by an interconnected system of social, environmental, and organizational elements. This model is particularly relevant to understanding handwashing in schools, as it recognizes that personal hygiene practices are shaped by not only individual knowledge but also by factors like access to water, the design of handwashing stations, and school policies (Bronfenbrenner, 1994). Studies employing SEM in hygiene-related contexts demonstrate that for sustained behavior change, interventions must address multiple levels of influence, including individual, community, and institutional factors (Lanfer et al., 2021). Thus, SEM provides a robust framework for examining the technical and social factors influencing students' handwashing habits.

Further supporting the SEM approach, Costanza's (2014) research emphasizes the importance of environmental and structural factors in shaping health-related behaviors, suggesting that merely focusing on individual education may not be sufficient to drive consistent hygiene practices. Costanza argued that the socio-ecological perspective facilitates a comprehensive understanding of how access to resources, such as water and soap, interacts with personal attitudes and social norms to determine behavior. For instance, in settings where handwashing facilities are unavailable or inconveniently located, students may lack the motivation to wash hands, even if they are aware of its importance (Costanza, 2014). By incorporating SEM, this

study on school handwashing practices can examine how school infrastructure, like the location and maintenance of handwashing stations, impacts pupils' ability to maintain hygiene.

Moreover, Dreibelbis et al. (2016) applied SEM in Tanzanian schools and demonstrated how infrastructure, such as foot-pedal-operated handwashing stations, can reduce contamination risks and promote consistent hand hygiene practices. Their findings showed that the design and placement of handwashing facilities could influence usage rates and hygiene behaviors among students, aligning with SEM's framework that health behaviors are influenced by interconnected environmental and organizational elements. This evidence underscores SEM's suitability for this study's third objective, which focuses on understanding the technical factors that influence handwashing practices.

2.2 Empirical Review

Handwashing practices are essential for disease prevention, especially in reducing the spread of diarrheal diseases, respiratory infections, and other communicable diseases. However, the functionality and sustainability of handwashing practices are often influenced by technical factors, such as the design and location of handwashing stations, water availability, soap provision, and infrastructure maintenance. This review examines empirical evidence on the technical factors affecting handwashing functionality, focusing on water supply, infrastructure design, and materials for hand hygiene. Water availability is a fundamental technical factor that directly impacts handwashing functionality. Without a reliable water supply, handwashing stations cannot operate effectively, hindering users from practicing proper hand hygiene. Kumpel et al. (2018) conducted a study in rural India that demonstrated a significant increase in handwashing rates at schools with a reliable piped water supply, compared to those with intermittent or non-piped water sources. The study emphasized that consistent water access is crucial for maintaining functional handwashing facilities throughout the day. Similarly, Pickering et al. (2017) found that in Kenyan schools, intermittent water supply was a major barrier to regular handwashing. Schools without continuous water access often had empty or non-functional handwashing stations, resulting in lower handwashing frequency among students. This underscores the importance of reliable and continuous water systems to support sustained hand hygiene practices.

The design and location of handwashing stations also play a vital role in facilitating ease and frequency of handwashing. Studies have shown that handwashing facilities located conveniently (e.g., near toilets or eating areas) are used more frequently. Dreibelbis et al. (2016) found in Tanzanian schools that handwashing stations placed near toilets significantly increased post-toilet handwashing. Additionally, foot-pedal-operated stations were more effective than traditional taps, as they reduced the risk of recontamination. Similarly, Hulland et al. (2013) found in Ethiopian schools that "tippy taps"—simple, low-cost, and low-water-use handwashing devices—improved handwashing behavior in areas with limited water resources. These studies emphasize that the design and location of handwashing stations should be adapted to local conditions to ensure usability and functionality. Soap availability is another critical component of effective handwashing. The combination of soap and water significantly enhances the removal of pathogens. Saboori et al. (2013) found in Kenyan schools that regular soap provision increased handwashing rates by up to 60%, with schools equipped with soap dispensers reporting higher handwashing frequency and reduced diarrheal disease rates. However, functional soap dispensers require regular maintenance. Grover et al. (2018) found that in Bangladeshi schools, broken or malfunctioning soap dispensers led to sharp declines in handwashing rates. Schools that implemented routine maintenance for soap dispensers maintained higher levels of handwashing compliance.

The durability of handwashing infrastructure is also essential for sustaining long-term handwashing practices. Infrastructure that is easily damaged or hard to repair can lead to abandoned handwashing stations. Caruso et al. (2014) found in Zambian schools that many handwashing stations, made from low-quality materials, quickly became non-functional. The study highlighted the importance of using durable materials that can withstand high traffic, especially in school environments. Additionally, maintenance programs are crucial. A study by Garn et al. (2017) in Haiti found that schools with regular maintenance schedules, including repairs and soap restocking, had higher handwashing compliance compared to those without such programs. In areas with intermittent water access, effective water storage systems can help maintain handwashing functionality. White et al. (2019) found in Ugandan schools that those equipped with water storage tanks were more successful in maintaining functional handwashing stations during water shortages. The study emphasized the importance of investing in water storage solutions to ensure water availability for handwashing, particularly in areas with unreliable water supplies. Proper water management practices, including replenishing storage tanks, are essential. Schools that mismanaged water resources often had non-functional handwashing stations during peak times, underscoring the need for effective water management.

Incorporating innovative technology can further enhance the functionality and sustainability of handwashing practices. Ram et al. (2020) evaluated the use of automatic, sensor-operated handwashing stations in Bangladeshi schools. These stations minimized water wastage and eliminated contact with potentially contaminated surfaces, leading to improved handwashing behavior among students. Freeman et al. (2012) examined low-cost sensors in Kenyan schools that monitored handwashing station usage, providing real-time data on water and soap levels. Schools using sensor technology maintained higher handwashing compliance by efficiently managing resources and addressing shortages promptly. Environmental factors, such as climate and weather conditions, also impact handwashing functionality. Fisher et al. (2015) found in Nepal that handwashing stations exposed to direct sunlight experienced rapid water evaporation, causing shortages during the hottest parts of the day. Conversely, shaded stations remained functional for longer periods. Cold climates present additional challenges; McMichael et al. (2019) found in Mongolian schools that handwashing stations often froze during winter, making handwashing impossible. The study recommended installing insulated or heated stations to ensure year-round functionality. Lastly, the cost of installing and maintaining handwashing infrastructure significantly affects its sustainability. Heijnen et al. (2014) found in Cambodian schools that limited budgets led to the installation of low-cost, temporary handwashing facilities, which were prone to frequent breakdowns. In contrast, schools that invested in durable materials reported fewer infrastructure failures and higher handwashing rates. Financial constraints also affect the provision of soap and water. Schools with limited resources often struggled to restock soap or pay for water, leading to non-functional handwashing stations.

2.3 Conceptual Framework

This conceptual framework illustrates the relationship between technical factors (such as availability of water, design and location of handwashing stations, availability of soap, and the functionality of handwashing facilities) and pupils' handwashing practices in schools. The model posits that the technical aspects of handwashing infrastructure are critical determinants of students' engagement in regular handwashing, thereby impacting hygiene and health outcomes. This framework aligns with previous studies that underscore the importance of functional and accessible hygiene facilities in promoting hand hygiene compliance among school-aged children (Kumpel et al., 2018; Saboori et al., 2013).

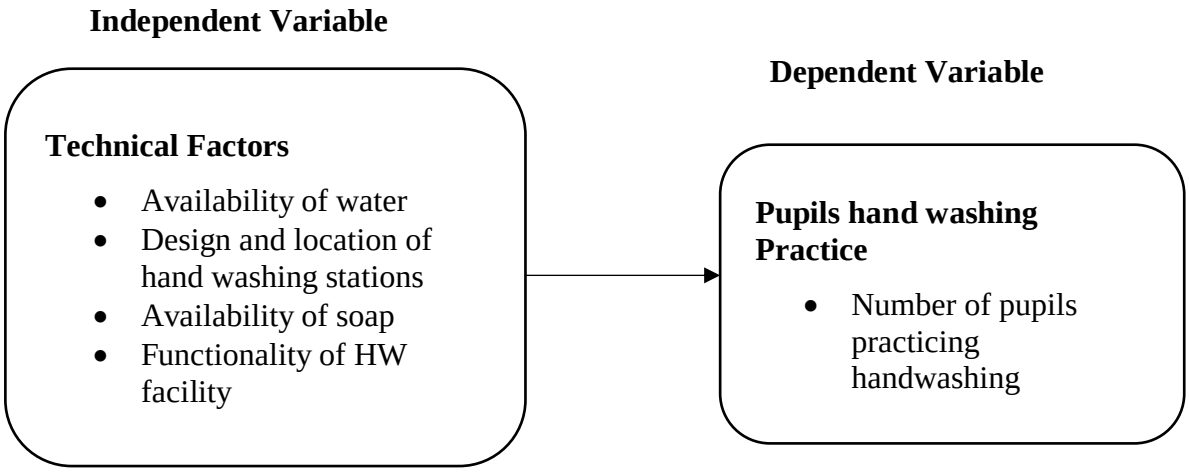

Figure 1: Conceptual Framework

3.0 Methodology

The study employed a cross-sectional survey design, focusing on students and head teachers within Lurambi Sub-County, Kakamega County, targeting a population of 37,514 pupils and 12 head teachers. Using the Taro Yamane formula, the sample size was determined to be 389 respondents, selected through cluster sampling for the sub-county's wards and purposive sampling to gather quantitative data from pupils. Data collection was conducted through questionnaires for students. Pilot testing was conducted to ensure reliability, and validity was assessed with input from WaSH experts. Quantitative data were analysed using descriptive statistics in SPSS. Ethical measures included maintaining participant confidentiality, voluntary participation, informed consent, and securing a research license from relevant authorities.

4.0 Findings and Discussions

The data collected included the number of functional handwashing stations, the presence of direct water connections, and observed issues like leaks. Observations revealed that in Nyayo tea zone primary school, out of seven handwashing stations, three were non-functional. Similarly, at Kakamega Muslim school, only one out of three handwashing stations was operational. None of the schools had direct water piping to the handwashing stations; instead, water was manually transported using buckets. A rotation system was implemented whereby students took turns filling and refilling the handwashing stations. Key informant interviews highlighted various challenges, such as frequent breakdowns of handwashing equipment, small station sizes, theft and vandalism of facilities, and lack of storage. Additionally, stations often needed repairs due to leakages, which compounded challenges and ultimately reduced the handwashing compliance among pupils. The lack of direct piping led to periods where handwashing facilities ran dry, particularly during lessons, forcing pupils to delay handwashing until break times.

Table 1: Functionality of Handwashing Stations and Technical Issues Observed

School Name	Total Stations	Functional Stations	Direct Water Connection	Observed Issues
Nyayo Tea Zone Primary	7	4	No	3 non-functional, frequent leaks
Kakamega Muslim Primary	3	1	No	Vandalism, limited size, leaks

Table 1 reveals that both Nyayo Tea Zone Primary and Kakamega Muslim Primary schools face substantial challenges with handwashing station functionality. Nyayo Tea Zone has seven stations, but only four are operational, with issues such as frequent leaks and the absence of a direct water connection, necessitating manual refilling. Kakamega Muslim Primary, with only one functional station out of three, also lacks direct water connectivity and suffers from vandalism, limited station size, and leakage issues. These technical limitations hinder reliable handwashing practices, emphasizing the need for improved infrastructure, direct water supply, and consistent maintenance to support better hygiene in schools. Key informant interviews revealed the need for improvements in water accessibility, piping, and station maintenance. The reliance on manual refilling of water during break times limited accessibility and consistency in handwashing. Additionally, challenges such as broken equipment, missing or stolen handwashing stations, and issues with storage and leakage highlighted systemic barriers in sustaining handwashing facilities.

4.1 Summary of Findings

The study's third objective explored the technical factors influencing the functionality of handwashing practices among pupils in public primary schools in Lurambi Sub-County, Kakamega County. Findings revealed that many schools faced significant challenges with maintaining functional handwashing stations. While schools had various types of water sources, such as shallow wells, boreholes, and rainwater harvesting systems, none had direct water connections to handwashing stations. This lack of direct piping required pupils to manually transport water, which hindered consistent handwashing, especially during class hours. Only one school out of the sample had a functional system with direct water access, while others had issues with station durability, leakage, vandalism, and inadequate maintenance. In some cases, pupils were assigned roles to refill stations, which sometimes led to gaps in availability. Additionally, several stations were broken or undersized, leading to overcrowding and decreasing pupils' motivation to wash hands regularly. These technical barriers underscore the need for reliable infrastructure to support sustained hygiene practices.

5.0 Conclusion

The study concluded that the functionality of handwashing stations in public primary schools in Lurambi Sub-County is hindered by technical limitations, including the lack of direct water piping, insufficient maintenance, and inadequate station capacity. While improved water sources like boreholes and shallow wells were more reliable, they did not automatically translate into better handwashing practices due to logistical issues. Pupils' hand hygiene was compromised, with limited access to functional and properly maintained stations resulting in suboptimal handwashing compliance. This shows that while schools may have access to water sources, technical and logistical challenges reduce the effectiveness of these facilities in promoting proper hand hygiene among pupils.

6.0 Recommendations

To improve handwashing functionality, it is recommended that schools receive adequate funding to install direct water connections to handwashing stations and to conduct regular maintenance on existing facilities. Community engagement and partnerships with local stakeholders could also help secure durable storage tanks and other equipment, ensuring consistent access to water.

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