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Assessment of hygiene and sanitation practices in an informal settlement dwelling: a case study of Kitwe City, Zambia

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Abstract

Access to safe water, sanitation, and hygiene services remains a major public health challenge in settlements across Sub-Saharan Africa. This study assessed the hygiene and sanitation practices of households in Kitwe City, Zambia. A cross-sectional survey was conducted between October and December 2024, involving 215 randomly selected households. Data were collected using a semi-structured questionnaire focusing on handwashing behavior, water treatment, water storage and sanitation facilities. The findings revealed that only 13.5% of respondents reported using soap for handwashing, and 59% of households consumed water without any form of treatment. Additionally, 38.6% of households stored water in uncovered containers, increasing the risk of microbial contamination. Sanitation facilities were predominantly unimproved, with 92% of households relying on pit latrines. These results highlight critical gaps in WASH practices, emphasizing the need for community level interventions to promote safe hygiene behaviors and improve sanitation infrastructure in low-income urban settings.

Keywords Settlement, Water, Hygiene, Sanitation, Public health, Interventions

1 Introduction

The demographic shift towards urbanization in Africa has resulted in population growth in urban areas. This has led to significant challenges in relation to water resource use and capacity of water systems. Many developing countries lack planned settlements in their urban areas, which contributes to the issue of slums and poor living conditions. Unfortunately, these areas often have inadequate sanitation services [1]. These settlements lack proper sanitation infrastructure and basic services, and they become hotspots for the improper disposal of human waste. In many informal settlements, access to toilets is limited, with some households relying on pit latrines or open fields. Additionally, high levels of water pollution contribute to water supply problems because human waste seeps into the soil and water sources [2]. The proximity of informal settlements to rivers, streams, and other water bodies further exacerbates the problem.

The USAID Expanding Water and Sanitation Project [3] estimates that over 6 million Zambians lack access to safe water and 11 million are without basic sanitation, and where infrastructure exists, investments in maintenance are lacking [4]. This situation is even more severe among the poorest quintile, where 60% of households do not have access to basic water services. Additionally, 64% of households across the country lack basic sanitation facilities, while a staggering 82% lack access to basic hygiene facilities.

Sustainable Development Goal 6 [SDG-6] emphasizes on ensuring access to safe water and improving sanitation and hygiene to ensure better health and wellbeing. Global evidence indicates an association between improper hygiene practices and infections like diarrhea [5]. Limited access to water, sanitation, and hygiene [WASH] is the primary cause of infections, such as diarrhea, in the country. Access to adequate water and sanitation is a significant developmental challenge in Zambia, particularly in peri-urban areas undergoing rapid expansion [6]. According to [7], diseases related to inadequate water and sanitation are transmitted through contaminated water, poor fecal disposal, poor hygiene practices, and inadequate water collection and storage therefore affecting the health of the people.

Addressing these challenges requires comprehensive strategies that encompass infrastructure development, community engagement, and policy interventions. In Zambia, efforts by organizations like UNICEF focus on enhancing equitable access to safely managed WASH services. Collaborative initiatives aim to construct and rehabilitate water supply systems, promote improved sanitation and hygiene practices, and strengthen the capacity of local communities to maintain these services sustainably [8]. However, despite these interventions, many informal settlements continue to face persistent WASH-related challenges due to rapid urbanization and limited resources. This study was conducted within that context, aiming to assess household hygiene and sanitation practices in areas where water-related diseases remain prevalent. By capturing these realities, the research offers practical insights that can inform sustainable WASH interventions in underserved communities.

2 Methods

2.1 Study site

The study was conducted in Ipusukilo, an informal settlement located within Kitwe City, Zambia, at latitude 12°45'S and a longitude of 28°20'E (Fig. 1). Ipusukilo was purposively selected due to its limited access to improved water and sanitation services, high prevalence of informal housing, and vulnerability to environmental health risks. The settlement has an estimated population of 31,405 [9], with an estimated 4,800 households.

2.2 Sample size and sampling procedure

The number of households sampled was determined using the Nassiuma formula [10], based on a total household population of 4,800, a coefficient of variation of 30%, and a margin of error of 2%. This yielded a final sample of 215 households.

Then, proportionate allocation of households per zone was done followed by simple random sampling (Fig 2). A random sample generator [RANDBETWEEN function in Excel] was used to select the required number of households from each zone until the desired sample size was reached.

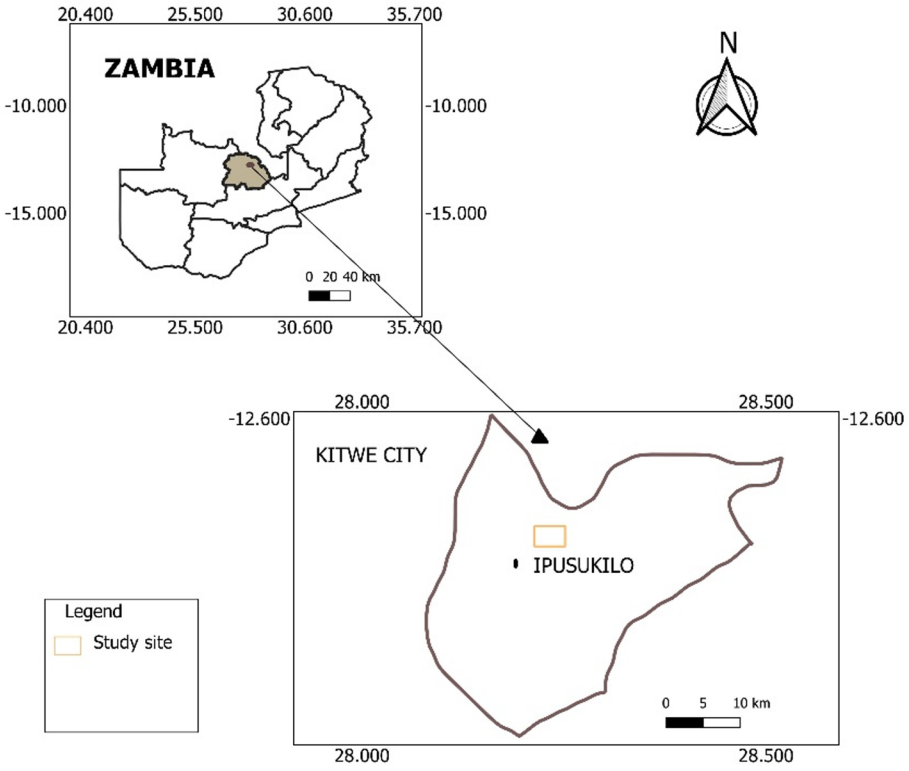

Fig. 1 Map of the study area

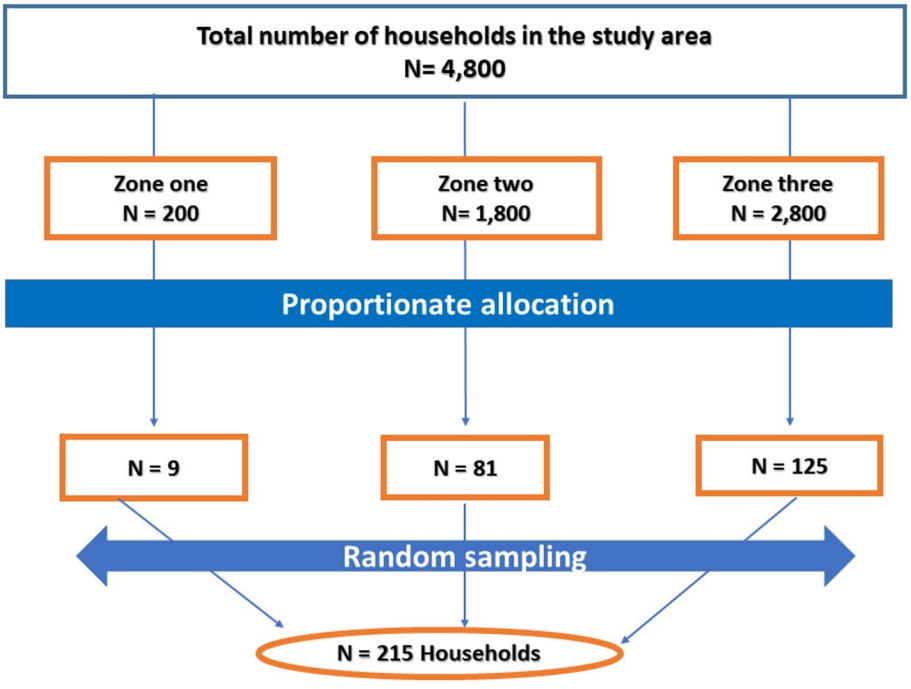

Fig. 2 Sampling process to determine hygiene and sanitation practices

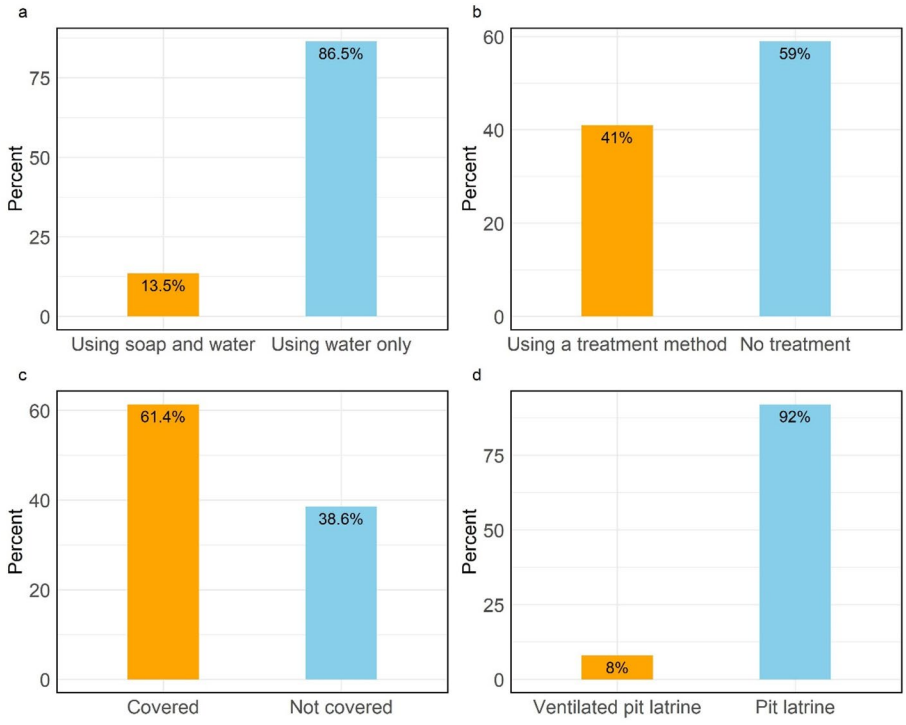

Fig. 3 Household hygiene and sanitation practices across four WASH indicators: **a** handwashing method, **b** water treatment status, **c** water storage coverage, and **d** sanitation facility type

2.3 Study design

A cross-sectional study design was employed to assess sanitation and hygiene practices among households. Semi-structured questionnaires were used, focusing on key aspects such as handwashing practices, water treatment and storage, and sanitation facilities used. These questionnaires were administered to household heads across selected households between October and December 2024. Face to face, interviewers were conducted, ensuring consistency in data collection and allowing for clarification of responses where necessary. Before participation, informed consent was obtained from all respondents, and the objectives and importance of the study were clearly explained.

2.4 Data analysis

Data analysis was conducted using IBM SPSS version 24, applying descriptive statistics, including frequencies and percentages, to summarize the results. Graphical illustrations were generated using R software to enhance the presentation of the findings.

3 Results and discussion

This study evaluated key sanitation and hygiene behaviors among households, focusing on handwashing practices, water treatment, water storage, and toilet facilities.

3.1 Handwashing practices

The findings indicated that only 13.5% of respondents reported washing their hands with both soap and water before meals, while a majority [86.5%] used water only (Fig. 3a]. This practice may be influenced by cultural norms, particularly in Zambia where it is common to eat with hands, especially when consuming nshima [the staple food] [11].

Many individuals prefer to wash their hands with water only before meals to avoid the soap smell interfering with the taste of the food. These findings have important public health implications. Handwashing with water alone does not adequately eliminate disease-causing microorganisms, increasing the risk of diarrheal diseases, intestinal infections, and other hygiene-related illnesses. Similar trends have been observed across sub-Saharan Africa. For instance, a recent study in Malawi reported that, low access to soap for handwashing was primarily due to households not prioritizing soap for hygiene purposes [12]. To encourage soap use without conflicting with cultural norms, strategies such as introducing unscented soaps can strengthen WASH efforts.

However, after defecation, 40% reported practicing handwashing with soap and water. This proportion is lower than the findings reported in Ethiopia, where 64.4% of individuals practiced handwashing with soap after defecation [13]. Handwashing with soap is crucial for removing pathogens and preventing the spread of disease, especially at critical times such as after using the toilet. Merely washing hands with water is insufficient, as it does not effectively eliminate pathogenic organisms. The World Health Organization emphasizes [14] that proper hand hygiene can reduce the incidence of diarrheal diseases.

3.2 Water treatment

Regarding drinking water safety, 41% of households treated their drinking water (Fig. 3b]. Among those who practiced treatment, 32% used a disinfectant [chlorine], while 9% opted for boiling. However, 59% of households consumed untreated water. This exposes a significant portion of the population to waterborne diseases. When comparing these findings to similar studies conducted in other sub-Saharan African contexts, a study in Ethiopia found that about 40% of respondents treated their drinking water [15, 16], indicating a comparable trend of low treatment rates.

The low uptake of water treatment methods may be influenced by several factors, including the cost and availability of treatment materials like chlorine, lack of awareness about the risks of untreated water, and possibly the taste or smell associated with treated water. Studies have shown that taste perception plays a role in whether households are willing to use chemical disinfectants, as some individuals find the chlorinated taste unappealing [17–19]. According to UNICEF Zambia [20] limited access to safe drinking water is a major contributor to the prevalence of waterborne illnesses such as cholera and diarrhea in the country.

3.3 Water storage practices

The most common source of drinking water in the settlement was shallow wells. Notably, 61.4% of households practiced covering their drinking water storage containers (Fig. 3c]. This practice is higher than the 41% reported in Ethiopia [21] but lower than the 91.7% observed in Sudan [22]. Covering water storage containers is a critical measure to prevent contamination from pathogens and environmental pollutants. The World Health Organization and UNICEF emphasize that such practices can significantly reduce fecal contamination and protect water from contamination thereby maintaining water quality and preventing diseases like diarrhea [23].

3.4 Sanitation facilities

The results showed that 92% of households used pit latrines, while 8% utilized ventilated pit latrines (Fig. 3d), reflecting common sanitation practices in low-income settings where infrastructure development is limited. This pattern aligns with findings from slum communities in Ethiopia, where 88.2% used pit latrines [24] and in Nepal 93.2% [25]. While pit latrines in slum areas are often promoted as cost-effective sanitation solutions, they present significant environmental and health risks [26–29]. Notably, contaminants from pit latrines can leach into groundwater, potentially polluting drinking water sources and posing health hazards. According to UNICEF Zambia [20], inadequate sanitation facilities significantly contribute to the transmission of waterborne diseases and pose serious risks to children's health, growth, and overall well-being. Addressing these persistent WASH challenges is essential to fostering a healthier, safer, and more resilient future for Zambia, particularly in underserved communities.

4 Conclusions

The study reveals critical gaps in hygiene behavior and sanitation infrastructure, highlighting the urgent need for targeted WASH interventions in informal urban settlements. Promoting handwashing with soap, encouraging household-level water treatment, and upgrading latrine facilities are essential steps toward reducing health risks. Community-based education campaigns and the provision of affordable water treatment solutions could significantly enhance hygiene outcomes. Given the high population density and associated environmental health risks, improving sanitation infrastructure must be prioritized. These findings offer valuable insights for designing WASH programs in similar resource-constrained urban settings across sub-Saharan Africa, where infrastructure limitations and behavioral practices intersect.

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Author contributions
SN, GMO, EM, and JN jointly conceptualized and designed the study. Data collection was undertaken by SN and JN. All authors were involved in data interpretation and contributed to the writing and revision of the manuscript.

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Data availability
The data is available upon request from the corresponding author.

Declarations

Ethics approval and consent to participate
The study protocol and questionnaire received ethical approval from Egerton University's Ethics Committee [Approval No. EUISERC/APP/364/2024] and the Ethics Committee of the Tropical Diseases Research Centre [Approval No. TDREC237/10/24].

Consent for publication
Permission to publish the research findings was obtained from the Zambia National Health Research Authority.

Competing interests
The authors declare no competing interests.

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