Scheduled desludging model and pit latrine emptying mitigation measures for peri-urban areas, Lusaka, Zambia: A hermeneutic phenomenological approach

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ABSTRACT

The study purpose was to improve the sanitation situation in George Compound, one of the peri-urban areas in Lusaka, Zambia. The researcher adopted an interpretive hermeneutic paradigm in which knowledge was established through Gadamer's hermeneutic cycle, relying on iterations and fusion of horizons by merging the researcher's background and participants' views. Epistemologically, the researcher adopted a subjective epistemological stance in which knowledge was generated through the researcher's personal experiences and reflective interaction with participants. Further, the researcher adopted a value-bound axiological stance, hence acknowledging his positionality in terms of personal background, experience, values, and beliefs. The study sample size was 29 participants, disaggregated as 10 males, 15 women, and 4 key informants. The study uncovers that scheduled desludging is a strategy that ensures predictable and affordable pit emptying. The study established that households register their pit latrines and make small routine contributions to facilitate emptying. The study further notes that the introduction of scheduled desludging enables community residents in the peri-urban areas to easily empty the pit latrines once they fill up. Moreover, the desludging has environmental and public health benefits, which include, among others, prevention of the pit latrines from overflowing due to delayed pit emptying of pit latrines by most customers, which is typical of most peri-urban areas in Lusaka. The study informs policy on strengthening the capacity of service providers to ensure a timely and efficient turnaround period for desludging. Ensure strengthening the environmental laws on licensing of transporters of effluent to avert desludging in the open environment premised on the low restorative charges that are significantly non-deterrent to the polluters. The study concludes that scheduled desludging is a game changer in resolving on-site sanitation pit emptying challenges given the financial constraints that many residents face. The study recommends strengthening capacities of service providers to ensure a timely and efficient turnaround period of desludging. The finding is novel because it offers peri-urban and institutional insights into pit emptying through scheduled desludging, considering that desludging previously lacked a scheduled plan; as a result, most households chose to relocate and construct new pit latrines elsewhere. The study purpose was to improve the sanitation situation in George Compound, one of the peri-urban areas in Lusaka, Zambia.

Keywords: Scheduled Desludging, Partial Payment, Pit Latrine Emptying, Stakeholders Participation.

I. INTRODUCTION

The Government of Zambia remains committed to accelerating universal access to water supply and sanitation to achieve a healthy and productive nation (National Water and Sanitation Council [NWASCO], 2018). Pit latrines are the dominant form of sanitation in peri-urban areas, used by about 88% of households (Economic Commission for Africa [ECA], 2018). To improve public health, the government, with support from the African Development Bank (AfDB), constructed 5,000 household toilets in peri-urban areas (AfDB, 2015). However, sanitation challenges remain severe in peri-urban areas of Lusaka, where approximately 70% of the city's two million residents reside (Brown et al., 2019). Most households in Lusaka Province rely on on-site sanitation facilities, while only 15% are connected to the sewered network. Thirteen percent of the facilities used were improved toilets such as Ventilated Improved Pit (VIP) latrines, which can be safely managed if constructed to standard, while 19% of facilities were traditional and considered as 'unimproved' sanitation facilities (NWASCO, 2018).

Moreover, the sanitation situation is compounded by poor infrastructure and weak regulatory enforcement in most peri-urban areas (Lerebours et al., 2021). Equally, the roles and enforcement mandates among key regulators remain poorly defined, resulting in fragmented implementation of sanitation laws and standards (Netherlands Development Organisation [SNV], 2024). As a result of the poor sanitation situation in Lusaka, there have been recurrent outbreaks of cholera, typhoid, and dysentery, contributing to significant morbidity and mortality (Brown et al., 2012). Furthermore, these disease outbreaks cause the government to lose an estimated US$194 million annually due to poor sanitation—equivalent to 1.3% of Gross Domestic Product (GDP) (Brown et al., 2012). At the global level, approximately 3.4 million deaths occur each year from water-related diseases (World Health Organization [WHO] & United Nations Children's Emergency Fund [UNICEF], 2017). Therefore, the researcher explored stakeholders lived experiences in sanitation programmes in Lusaka's George Compound.

The novelty of this study lies in its development of new, context-specific insights into the lived experiences of residents in George Compound, a highly dense peri-urban settlement. The study captures local nuances, challenges, and adaptive strategies that are unique to this community and underrepresented in existing sanitation literature. These context-specific findings enrich the body of knowledge on peri-urban sanitation dynamics and provide a foundation for designing interventions tailored to similar urban informal settlements. Thus, this paper explored mitigation measures for the perceived sanitation challenges identified in Lusaka's peri-urban areas. The study was anchored on Sustainable Development Goal 6 (SDG-6), which aims to ensure the availability and sustainable management of safe water and sanitation for all by 2030 (United Nations General Assembly [UNGA], 2010).

At the regional level, according to Agenda 2063, access to proper sanitation remains elusive in many parts of Africa, with about 20% of the population in Sub-Saharan Africa still practicing open defecation (African Union [AU], 2015). Moreover, the increase of unplanned settlements has been a major drawback on government efforts to provide safe water and adequate sanitation (Government of the Republic of Zambia [GRZ], 2022).

1.1 Statement of the Problem

The Government of Zambia remains committed to accelerating universal access to water supply and sanitation to achieve a healthy and productive nation (NWASCO, 2018). Pit latrines are the dominant form of sanitation in peri-urban areas, used by about 88% of households (ECA, 2018). To improve public health, the government, with support from the African Development Bank (AfDB), constructed 5,000 household toilets in peri-urban areas (Brown et al., 2012).

Sanitation challenges, however, remain severe in peri-urban areas of Lusaka, where approximately 70% of the city's two million residents reside (Brown et al., 2012). Most households in Lusaka Province rely on on-site sanitation facilities, while only 15% are connected to the sewered network. Thirteen percent of the facilities used were improved toilets, such as Ventilated Improved Pit (VIP) latrines, which can be safely managed if constructed to standard, while 19% of facilities were traditional and considered as 'unimproved' sanitation facilities (NWASCO, 2018).

Moreover, the sanitation situation is compounded by poor infrastructure and weak regulatory enforcement in most peri-urban areas (Lerebours et al., 2021). The roles and enforcement mandates among key regulatory actors remain poorly defined, resulting in fragmented implementation of sanitation laws and standards (SNV, 2024). As a result of poor sanitation in Lusaka, there have been recurrent outbreaks of cholera, typhoid, and dysentery, contributing to significant morbidity and mortality (Brown et al., 2012). Furthermore, these disease outbreaks result in an estimated annual loss of US$194 million due to poor sanitation, equivalent to 1.3% of GDP (Brown et al., 2012). Similarly, approximately 3.4 million deaths occur each year from water-related diseases globally (WHO & UNICEF, 2017). Therefore, the researcher explored stakeholders lived experiences in sanitation programmes in Lusaka's George Compound.

1.2 Research Objective

The objective of this paper was to address sanitation challenges through scheduled desludging in Lusaka's peri-urban areas.

1.4 Research Question

How can the stakeholders perceived sanitation challenges be mitigated in Lusaka's peri-urban areas?

II. LITERATURE REVIEW

2.1 Theoretical Review

The study adopted systems theory, developed in the 1940s by biologist Ludwig von Bertalanffy. Systems theory is a conceptual framework based on the principle that the components of a system can best be understood in the context of their relationships with each other and with other systems, rather than in isolation (Wilkinson, 2011). Systems theory

has significantly influenced our understanding of organizational behaviour and change, and a systems approach can increase our ability to identify the underlying causes of problems and determine optimal solutions (Wilkinson, 2011). Systems thinking examines systems from the perspective of the entire system, interrelated subsystems, and repetitive patterns among subsystems. Systems thinking provides a holistic analytical method to analyse how a system's components relate and function over time and within the context of larger systems. It is useful for complex or complicated problems that cannot be solved by a single entity, as complex systems cannot be effectively understood from only one perspective (Beehner, 2025).

This theory aligns with the study's ontological position, which holds that reality is multiple and requires understanding the whole by its various parts. In this context, applying systems thinking helps in understanding stakeholders' experiences of sanitation programme implementation as well as how systems interact to address sanitation challenges in the study area, thus assisting the researcher in the interpretation and discussion of findings.

2.2 Conceptual Review

Desludging is recognized as an important strategy for urban sanitation improvement, particularly in unplanned urban settlements (United Nations [UN], 2019). In unplanned urban settlements (UUSs), land space for the construction of new sanitation facilities to replace those filled up by accumulating faecal sludge (FS) is lacking (Strande et al., 2014). Thus, desludging remains the only option to keep the facilities usable (Strande et al., 2014). The study explored this aspect and established similarities for most of the peri-urban areas. Nevertheless, desludging services have remained inadequate in most UUSs. Residents in these areas use sanitation facilities which are full beyond their safety levels. Alternatively, they desludge them using unhygienic methods, thus posing public and environmental health risks (Strande et al., 2014). The study found that desludging services offered by traditional pit emptier's were unhygienic, but those offered by trained and certified emptier's were hygienic and complied with standard operating procedures and regulations.

On average, it is estimated that cities in low- and middle-income countries (LMICs) only safely manage 50% of the total amount of faecal sludge generated (Strande et al., 2014). The remaining amount is either left in pits for a long period or haphazardly disposed of in the surrounding environment, posing serious public and environmental health risks (Strande et al., 2014). As an essential part of the sanitation service chain, hygienic desludging facilitates the effective collection of faecal sludge for further processing and subsequent reuse (Strande et al., 2014). The persistence of unhygienic desludging practices warrants thorough investigation to enhance the benefits of hygienic desludging for human health and the environment. Recently, there has been increasing recognition among sanitation practitioners of the multidimensional structure of the sanitation service system (Dreibelbis et al., 2013; Tilley, 2024).

Seleman et al. (2020) observed a lack of monitoring and evaluation systems for desludging, lack of guidelines on installation of mechanisms for identifying when latrines are filling up, and outdated laws with relatively low penalties against manual pit emptying and onsite disposal. Regarding routine monitoring of desludging practices, the study found that desludging services or practices are lacking in the routine sanitation and hygiene monitoring and evaluation (M&E) system. As such, the magnitude of the desludging problem goes unnoticed. Similarly, the national sanitation and hygiene guidelines lack instructions on the installation of features for observing when the pit is getting full, especially for toilets with an offset pit such as pour flush. As a result, residents are unaware of when the pit becomes full and are unable to prepare financially for hiring hygienic desludging services (Seleman et al., 2020).

Furthermore, there is limited documented information about pit latrine inspection installation in the study area. On analysis of regulations for desludging and faecal sludge management (FSM) in general, the study found that regulations used for controlling open discharge of faecal sludge through flooding out or onsite disposal through methods such as pit diversion are outdated, with relatively low penalties. For example, in Ilala Municipal Council, the penalty for indiscriminate discharge of domestic wastewater under the Local Government Act (LGA) of 2002 is Tanzanian Shilling (TZS) 50,000 (US$21.9) (Seleman et al., 2020). Additionally, a high-water table was found to be a major contributing factor for reliance on unhygienic desludging. Due to the high-water table, water percolates into the pit, resulting in toilets filling up quickly, especially during rainy seasons. Some residential houses are required to desludge every three months. This results in desludging being seen as an expensive service (Seleman et al., 2020).

Seleman et al. (2020) also found that unclear distribution of responsibility for desludging between landlords and tenants was a significant factor influencing unhygienic desludging. In rented houses, responsibility for desludging is usually not explicitly stated in any contract. The general practice is to share desludging charges between landlord and tenant. The challenge arises when one party does not have money at hand to contribute to the cost when the toilet is full. In most cases, residents resort to releasing small amounts of faecal sludge through flooding out until enough money is collected for hiring a vacuum tanker. Gender roles and wealth were also found to influence unhygienic desludging. In the study areas, men spend most of their time away from home doing income-generating activities, while women stay at home and carry out family-related activities such as housekeeping and caring for the young and those going to school. Because men are often in charge of finances, landlords face difficulties contacting male tenants for desludging cost-

sharing. Women experience the full latrine more by sight and smell and thus have more incentive to desludge. The study also found unstable and fluctuating incomes among residents in UUSs. The quantitative part of the study found that across the study areas, only 206 (52.2%) had at least one family member with a bank account, most of whom reported having only the minimum allowable balance (Seleman et al., 2020).

The Energy and Water Utilities Regulatory Authority (EWURA, 2020) disclosed that solid items are thrown into the pits and eventually clog desludging equipment, increasing desludging time and energy consumption. Operators were reported to discontinue pumping pit contents when they find large quantities of solid waste. Improvement of desludging in these areas should therefore be accompanied by education on the proper disposal and management of solid waste, especially taboo-ridden and culturally sensitive waste such as menstrual waste, which is often disposed of in the latrine pit (EWURA, 2020). At the community level, unavailability of desludging services was found to be a significant factor for over-reliance on unhygienic desludging. In the study areas, locations where residents can access services or obtain phone numbers to call for safe desludging services were lacking. This is contrary to other basic infrastructure services, such as water supply and solid waste collection, where water kiosks and solid waste collection centres have been provided or identified, respectively (Seleman et al., 2020).

The study conducted by Tilley (2024) found that technological factors at the interpersonal/household level contributing to unhygienic desludging include a lack of clear modalities for accessibility and affordability of desludging technology, such as cost-sharing for hiring desludging equipment. In rented houses, landlords take the lead in collecting contributions and deciding on desludging methods or the size of the vacuum truck to be hired. The problem arises when the toilet fills up quickly after desludging, making tenants skeptical about the amount paid or the size of the vehicle hired. Dissatisfied tenants are less likely to contribute next time the pit gets full. When this happens, toilets stay full for a long time without being desludged, or the landlord discharges some faecal sludge volume, referred to as ‘kupunguza’ (shrink) in Swahili, or waits for the pit content to shrink during the dry season (Seleman et al., 2020). There is a need to consider drivers of behavioural change in planning for improvement of faecal sludge management (FSM); however, this idea has not yet been put into practice. The purpose of this study was to determine drivers of unhygienic desludging practices by investigating contextual, psycho-social, and technological factors influencing current desludging practices in UUSs of Dar es Salaam (Tilley, 2024).

Jaiswal et al. (2022) established that the common practice for desludging of septic tanks is ‘demand-based desludging’ rather than regular service, which has adverse social and environmental impacts. Scheduled desludging is advocated to maintain the performance of septic tanks and avoid adverse effects on the environment. Wai, a small town in Maharashtra, India, is the first city in India to implement scheduled desludging. The quality of water before and after scheduled desludging is assessed, monitoring groundwater, river water, effluent from drains, and supernatants from septic tanks. Results suggest a positive impact of regular desludging on septic tank performance, improving the quality of drain water, groundwater, and river water.

The city of Wai implemented scheduled desludging as a municipal service partially financed by a sanitation tax. A private company provides desludging service on a ‘pay-for-performance’ basis by the city government (Jaiswal et al., 2022). The Central Public Health and Environmental Engineering Organization guidelines recommend that the settled solids from a septic tank be desludged regularly for it to function well, suggesting yearly desludging, but if not feasible, tanks should be cleaned at least once in 2–3 years or as needed (Chirgwin et al., 2021). Outdated laws with low penalties and lack of routine data are key contextual factors. Psycho-social factors include perceived inability to control unhygienic desludging and lack of shame among those performing unhygienic desludging. Technological factors relate to the weakness in existing desludging technologies and skepticism about the performance of manual desludging hand pumps (Seleman et al., 2020).

The study further found that the perceived inability to control unhygienic desludging among community members and lack of shared values against flooding out of faecal sludge maintain the status quo of unhygienic desludging practices. The reliance on unhygienic desludging is exacerbated by weak and poorly performing desludging technologies, including vacuum trucks and small-scale equipment. Improvement in FSM, particularly regarding desludging, should consider the multiple forces hindering safe and reliable desludging. A necessary step to start improvement is amending municipal by-laws to reflect requirements of the Public Health Act 2009 on flooding out practices. Other steps include instituting routine monitoring for desludging services and investing in education and behaviour change to increase understanding of sanitation facilities suitable to local context and available desludging technological options (Seleman et al., 2020). The scheduled desludging model benefits all stakeholders along the FSM chain and can improve service functionality. This enables informal settlement dwellers to plan for desludging their sanitation facilities, reducing the risk of environmental pollution from faecal matter during the rainy season (Kulabako et al., 2007).

For service providers, this model improves business operations, likely increasing profit margins through additional revenue gains from economies of scale resulting from more clients and trips (Rao et al., 2016). For city authorities, the model ensures city-wide coverage of services, supporting efforts to eliminate manual emptying and

enforce standards in latrine and septic tank construction, making it easier to regulate and plan for scheduled emptying. For the National Water and Sewerage Corporation (NWSC)/treatment plant, the model positively impacts the quality of faecal sludge delivered for processing and planning of treatment (Chowdry & Kone, 2012). The environmental regulator, National Environment Management Authority (NEMA), needs to enhance effective monitoring of service providers to ensure compliance with waste transportation regulations. With support from local leaders and community activation teams in informal settlements, emptying schedules can be locally arranged, as piloted with mobile transfer stations (Mawejje et al., 2018).

2.3 Empirical Review

The Netherlands Development Organisation (SNV, 2024) found that the risk associated with on-demand emptying of containment systems is that it typically occurs only when full or overflowing. Introducing a scheduled desludging model means emptying occurs based on a pre-agreed schedule, preventing overflows. An additional feature replaces the traditional lump sum payment for emptying services with a more affordable monthly payment scheme. This change made the service accessible to all income groups, with an agreed two-year emptying cycle and a monthly fee of ZMW 15 (EUR 0.67) that fully covers service costs, replacing the previous lump sum of ZMW 550 (EUR 24) (SNV, 2024). With scheduled desludging implemented in the peri-urban area of Kamushanga, uptake of scheduled emptying subscriptions grew rapidly, with 92% of the population subscribing.

This widespread acceptance demonstrates that, when suitable and economical solutions are available, there is significant demand for safe emptying services. The pivotal factor was increased service affordability and availability of reliable and professional service providers. The scheduled desludging model in Kabwe can contribute to the financial sustainability of the utility, resulting from an expanded customer base and increased efficiency, as the service becomes predictable and is strategically outsourced to private sector operators (SNV, 2024). The Lukanga Water and Sanitation Company partnered with local operator Twikatane, supported by SNV to formalize, equip and train its members. This initiative expanded service coverage and guaranteed adherence to strict occupational health and safety standards throughout the sanitation chain, from household collection to disposal at the treatment site. A pre-defined schedule also benefits the operator, who can now anticipate revenue, as opposed to previously unpredictable income under an on-demand model. The introduction of a scheduled desludging plan in Kabwe has set a benchmark for professional and reliable service, significantly increasing accountability as subscribed users demand that the utility delivers on its pre-defined schedule, and that emptiers provide a quality service (SNV, 2024).

Greene et al. (2021) noted that scaling up the scheduled emptying model requires investment that utilities may struggle to raise, as more vehicles, equipment and operators are needed. Treatment capacity must also be expanded to manage increased sludge loads. In terms of consumer behaviour, households tend to dispose of solid waste in their toilet pits, making emptying arduous and time-consuming, and creating constraints at the treatment end as the sludge includes non-decomposable materials. The quality of toilets is another limitation, as households often build unlined toilets that collapse during emptying. Onsite sanitation is often perceived as requiring large investments with little return, similar to sewers. Business model assessment, including scheduled desludging, is not yet common practice for service providers. Accessibility is a major factor influencing the choice of an emptying method, especially in unplanned settlements with poor roads (Kennedy-Walker et al., 2015). Poor design and construction of containment facilities, with limited or no access for emptying, also pose challenges (Holm et al., 2018). Accessing finance is difficult, as banks and private entrepreneurs are reluctant to invest in pit-emptying businesses (Opel et al., 2011).

Some households with little or no money to pay for emptying services resort to gravitational emptying, the most dangerous method, as large volumes of untreated faecal sludge are discharged into the environment (Jenkins et al., 2015). Manual emptying, while cheaper, poses significant health risks to users, emptiers and the environment in the long run. Although mechanical emptying is generally more expensive, some studies reported that manual emptiers may demand exorbitant prices in areas inaccessible by mechanical emptiers (Jonathan & Masudul, 2008). Muxímpua and Hawkins (2012) disclosed that manual emptiers in Kibera, Nairobi, face social challenges such as violence and extortion, and in Maputo, Mozambique, they often face harassment. Manual emptiers are marginalized, considered to be doing undignified work, and often operate at night to avoid being seen (Muxímpua & Hawkins, 2012). Manual emptiers also face financial burdens from high healthcare costs, as they lack health insurance or compensation for lost workdays due to illness.

Mougoue et al. (2012) revealed that technical challenges faced by faecal sludge emptiers were reported in 14 studies. The main technical challenge was poor construction of sanitation facilities. In Maputo, Mozambique, and in Duala and Yaoundé in Cameroon, households build facilities without following technical standards, posing risks to emptiers. The lack of regulation leads to imbalanced competition, as companies pay taxes, but individuals do not (Akumuntu et al., 2017). In Yaoundé, Cameroon, public authorities impose taxes at disposal sites, but revenues are not reinvested in the system. Prices for emptying fluctuate due to unofficial fees and bribes paid by emptiers.

III. METHODOLOGY

3.1 Research Paradigm

The study was anchored on an Interpretive Hermeneutic Paradigm and viewed reality from a relativist ontology, which holds that multiple realities exist. Scotland (2012) asserts that reality is relative to how individuals experience it at any given time and place. According to Scotland (2012), ontology is defined as a branch of philosophy concerned with the assumptions we make to believe that something makes sense or is real, or the very nature or essence of the social phenomenon being investigated. Further, Scotland (2012) posits that, in line with this definition, the researcher studied reality by integrating multiple perspectives.

In terms of epistemology, the researcher adopted a subjective epistemological stance, in which knowledge is generated through the researcher's personal experiences and interaction with participants, as established by Kivunja and Kuyini (2017). Using this stance, the researcher generated knowledge through co-construction and interpretation of meaning from the participants' experiences. Additionally, the researcher adopted a value-bound axiological stance, acknowledging that their own positionality—in terms of personal background, experience, values, and beliefs—influenced the study while prioritizing ethical considerations. Kivunja and Kuyini (2017) define axiology as the ethical issues that must be considered when planning a research proposal. Given the nature of the approach adopted, the research was value-bound and thus inseparable from the researcher (Saunders et al., 2009). Therefore, positionality in this study helped integrate the researcher's beliefs and experiences in the co-construction of meaning during the study.

Lastly, the researcher deployed a methodological stance covering the research approaches, designs, methods, and procedures used in a well-planned investigation (Keeves, 1997). Inductive reasoning is a logical process in which multiple premises, believed true or found true most of the time, are combined to obtain a specific conclusion or supply evidence for the truth of a conclusion (Sauce & Matzel, 2017). The researcher applied inductive logic in data collection and analysis, reasoning from the specific (participants sampled) to the general (study area).

3.2 Research Design

The researcher adopted an exploratory case study design to gain in-depth insights about sanitation by focusing on a single case. Gerring (2004) emphasizes that a case study is an intensive study of a single unit for understanding a larger class of similar units, where the unit refers to a spatially bounded phenomenon observed at a single point in time or over some delimited period. According to Cresswell (2007), a case study is a suitable approach when the inquirer has identifiable cases with boundaries and seeks to provide an in-depth understanding of the cases or a comparison of several cases.

3.3 Sampling, Location, Population, and Procedure

3.3.1 Study Location

The study was conducted in George Compound, one of the peri-urban areas located west of Lusaka. The study area was selected based on the sanitation programme interventions implemented there by the Government of Zambia through the Lusaka Sanitation Program.

3.3.2 Study Population

The study population is defined as a set of cases that are determined, limited, and accessible, and that constitute the subjects for sample selection, who must fulfil several characteristics and distinct criteria (Arias-Gómez et al., 2016). The population of George Compound is 71,566 in Lima Ward (Zambia Statistics Agency [ZAMSTAT], 2022). The population for this study was 29 participants. These participants comprised representatives from sanitation programmes, the Ward Development Committee, the Water and Sanitation Committee, the Lusaka City Council (Public Health Department), Zambia Environmental Management Agency (Inspectorate), National Water Supply and Sanitation Council (NWASCO), and Lusaka Water Supply and Sanitation Company (Peri-Urban Department). The population was selected based on their experience working with sanitation programmes in peri-urban areas.

3.3.3 Study Sample Size

The researcher adopted a qualitative research approach, with the sample size determined based on the principle of data saturation. Suri (2011) notes that data saturation occurs when further data collection yields little in terms of new themes, insights, perspectives, or information. The sample size was determined after conducting interviews with 29 participants (10 males and 15 females) and 4 key informants.

3.3.4 Sampling Procedure

Purposive sampling is the intentional selection of informants based on their ability to elucidate a specific theme, concept, or phenomenon (Robinson, 2014). The researcher employed criterion-based purposive sampling, which

requires setting specific criteria for participant selection. These participants were handpicked because the criteria enabled relevant data collection (Haruna, 2023). Participants who had experienced and benefited from the sanitation programmes implemented by the government over the past ten years were selected. Government stakeholders were chosen based on their experience implementing sanitation programmes in the study areas. The selected participants comprised beneficiaries of sanitation programmes, the Ward Development Committee, the Water and Sanitation Committee, the Lusaka City Council (Public Health Department), Zambia Environmental Management Agency (Inspectorate), National Water Supply and Sanitation Council (NWASCO), and Lusaka Water Supply and Sanitation Company (Peri-Urban Department).

3.4 Data Collection Instruments

Primary data were collected using key informant interviews targeting government officials and community opinion leaders, and in-depth interviews targeting sanitation programme beneficiaries.

3.4.1 Key Informant Interviews

The researcher deployed key informant interviews (KIIs) because of their capacity to conduct intensive individual interviews with a small number of respondents, exploring their perspectives on a particular idea, programme, or situation. This method is appropriate for open-ended questions in qualitative studies. KIIs are a valuable qualitative method aimed at collecting in-depth insights and viewpoints from individuals with specialized expertise (Akhter, 2022). The method involved one-on-one interviews with government officials and community leaders based on their experience in the sector or with sanitation programme interventions in the study area.

3.4.2 In-Depth Interviews

In-depth interviews were used to generate qualitative data. These interviews can be unpredictable and varied, making them well suited for exploratory research and studies interested in meaning and experience (Osborne & Grant-Smith, 2021). This data collection instrument was appropriate for gathering sanitation beneficiaries lived experiences in an unrestricted manner, as opposed to structured instruments that restrict participants' responses.

3.4.3 Data Collection Procedures

Self-administered interviews were conducted in the field to elicit participants' views and experiences. Interviews were conducted either in English or translated into the local language spoken by the participant. Study participants were selected using criterion-based purposive sampling. The interviews lasted between 50 to 60 minutes, and audio-recording devices were used after obtaining consent from participants.

3.5 Data Analysis

Raw data were analysed manually using a reflexive thematic analytical approach. Thematic analysis is an appropriate method for seeking to understand experiences, thoughts, or behaviours across a dataset, with themes being actively constructed patterns or meanings derived from the data that answer a research question, rather than mere summaries or categorizations of codes (Kiger & Varpio, 2020). The study adopted the Braun and Clarke framework for thematic analysis, which involves six steps: data familiarization, generating initial codes, identifying themes, reviewing themes, defining and naming themes, and producing the report (Kiger & Varpio, 2020). These themes helped build patterns for interpreting the study findings in line with the study objectives and purpose.

3.6 Study Trustworthiness

The researcher ensured rigour by employing trustworthiness, which, according to Lincoln and Guba, relies on four criteria: credibility, transferability, dependability, and confirmability (Ahmed, 2024). Credibility was achieved by building trust and rapport with participants, allowing the researcher to gain nuanced insights into their experiences, behaviours, and beliefs. This also helped capture rich data that might not be evident during brief interactions (Ahmed, 2024). Transferability was achieved by thoroughly describing the research context, participants, and methods, enabling readers to evaluate the relevance of findings to their own settings (Ahmed, 2024). Dependability was ensured by thoroughly documenting each step of the research process, facilitating transparency and allowing others to replicate the study or assess its dependability by following the same procedures and understanding the rationale behind decisions made (Ahmed, 2024). Eryilmaz (2022) notes that creating and preserving an audit trail—a comprehensive log documenting decisions made throughout the research process—enables other researchers to reproduce the study, ensuring the dependability of the results. Confirmability was achieved by employing member checking to ensure that participants' viewpoints and experiences were accurately represented. This strengthens confirmability by providing participants the opportunity to validate or correct interpretations. Additionally, keeping a journal helped the researcher track evolving thoughts, biases, and reflections during the research process. This reflective practice enhances

transparency and provides insights into the researcher's subjectivity, contributing to the confirmability of the findings (Ahmed, 2024).

IV. FINDINGS & DISCUSSION

This section presents the study findings and the participants verbatims which were coded and anonymised by initials of the study area i.e. George Compound (GC) for beneficiaries and KII for the Key informants. The collected raw data from the field employed the open-ended interview guides in which the interview scripts were analysed using a reflexive thematic analysis which applied fusion of horizons and hermeneutic cycle to decipher the findings in line with the study objectives. The following are the findings:

4.1 The Scheduled Desludging Strategy

4.1.1 Registration of Pit Latrines

Scheduled desludging was introduced to ensure predictable and affordable pit emptying. Households register their pit latrines and make small routine contributions. A key informant described that:

> *A customer in the peri-urban area must register that they have a pit latrine; once they register, they paid a small amount towards desludging.* (KII, LWSC).

4.1.2 Timely Emptying of Pit Latrines

The study uncovered that the introduction of the scheduled desludging enables the community residents in the Peri-Urban areas to easily empty the pit latrines ones they fill up. This strategy is being piloted in most Peri-Urban areas of Lusaka. An extraction from the key informants narrates that:

> *So that when the toilet fills up, they just call the service provider." This system empowers residents and encourages construction of lined and emptiable toilets. As further noted, "It brings the peri-urban residents to participate in sanitation service provision.* (KII, LWSC).

4.1.3 Environmental and Public Health

The desludging has environmental and public health benefits which include among others prevention of the pit latrines from overthrowing due to delayed pit emptying of Pit Latrines by most customers which is typical of most peri-urban areas in Lusaka. One of the key informants interviewed narrated that:

> *This has a direct benefit for environmental and public health by curtailing pit overthrow*. (KII 2).

4.1.4 Flexible Payment Model

The study unravels flexible payment arrangements which makes it easier for most of the community stakeholders to make sanitation charges towards pit emptying when full. This is better than waiting until the pit fills up which usually makes it difficult for most of the households to raise the required money for them to have their latrines emptied. In testimony to the above finding, one of the key informants interviewed expressed that:

> *We are trying to strengthen the sanitation service delivery model by piloting the scheduled desludging model which is an organised way of pit emptying frequency which is being piloted in George, Kanyama and chawama. This model enables the customers to pay small contributions which makes it easier for their pit to be emptied once they fill up.* (Participant GC 22)

4.1.5 Solid Waste Challenges

Some of the community beneficiaries narrated that they faced challenges of delayed emptying of the toilets by the service providers when the toilet fills up and inconsistent emptying charges are a challenge for the community beneficiaries. One of the community beneficiaries narrated that:

> *Those who come to empty the toilets usually delay coming and they have different charges for emptying the toilet when it is full.* (Participant GC 19)

4.1.6 Bury Pit latrines

The study revealed that most people in the Peri-Urban areas do not have plans to have their Pit emptied and they tend to bury the toilets once they fill up. This practice tends to pollute the underground water given that people use underground water from the shallow wells hence this creates public health challenges.

> *There is no plan for Pit emptying by most of the people in the Peri-Urban areas since they have not fully embraced the idea of Pit emptying. People do not have enough water and when their toilets fill up, they tend to bury them, and this affects underground water quality given that people use shallow wells hence this creates a sanitation situation.* (KII, LCC).

4.1.7 Solid Waste and Texture

Additionally, the community beneficiaries faced quick filling up of the toilets because they are also used as solid waste dumping pits. They also face the challenge of lighting affecting their visibility at night and this is attributed to loadshedding. One of the community members submitted that:

> *The other challenge is that the toilets fill up fast because people are dumping solid waste in the latrines. There's also poor lighting at night which makes us not see clearly. We also face water challenges due to lack of water in some areas due to load-shedding.* (Participant GC 6).

The study finds out that most pit latrines are also used for dumping solid waste which affects the texture and increases cost for separation of sludge from solid waste. An extraction from one of the key informants avers that:

> *There is also the challenge of solid waste disposal in the pit latrines which also affects the texture of the sludge as well as cost of separation.* (Source LWSC).

4.1.8 Willingness to pay for Pit Emptying Services

The study revealed that people are not willing to pay for Pit emptying services and there are poor roads network in most peri-urban areas making it inaccessible by trucks transporting faecal matter. Further people also face financial challenges. One of the Key informants revealed that:

> *Not so many people want to pay for Pit emptying services and there are no roads making it difficult for the Peri-Urban areas to be accessed. Moreover, most of the toilets are not built to standards hence most people resort to using the informal Pit emptier.* (Source KII- LCC).

4.1.6 Water Table Challenges of Desludging

The study found out that most of the pit latrines fill up quickly due to the raised water table. One of the key informants expressed that:

> *The pit latrines in some of the areas in George compound fill up quickly because of the high-water table* (Participant GC 8).

4.2 Discussion

The study revealed that service providers take a long time to respond to service provision in peri-urban areas. This finding is consistent with Seleman et al. (2020), who posit that at the community level, unavailability of services is a key factor contributing to over-reliance on unhygienic desludging. In the study areas, locations where residents can access services physically or obtain a phone number for safe desludging services were lacking. This is contrary to other basic infrastructure services, such as water supply and solid waste collection, where water kiosks and solid waste collection centres have been provided or identified, respectively.

The study found that tenants are willing to contribute and pay for other utilities, such as electricity, whereas cooperation tends to be lacking regarding sanitation services. Moreover, even when people are willing to contribute, the departure of a tenant often creates challenges in emptying the toilets, illustrating the need for scheduled desludging to address this issue. Seleman et al. (2020) also noted that technological factors at the interpersonal/household level contributing to unhygienic desludging include the lack of clear modalities for accessibility and affordability of desludging technology, specifically the need for cost-sharing when hiring desludging equipment. In rented houses, landlords collect contributions and decide on the desludging methods or size of the vacuum truck to hire. Problems arise when the toilet fills shortly after desludging, causing tenants to become skeptical about the money paid to the operator or the vehicle hired. Dissatisfied tenants may be reluctant to contribute the next time the pit is full. As a result, toilets may remain full for a long time without being desludged, or the landlord may discharge some faecal sludge (FS) to shrink the volume—an action referred to as 'kupunguza' (shrink) in Swahili—or may wait for the pit content to shrink naturally during the dry season (Seleman et al., 2020).

The study found that scheduled desludging offers flexible payment arrangements, making it easier for most community stakeholders to pay sanitation charges for pit emptying when full. This is preferable to waiting until the pit fills up, which usually makes it difficult for households to raise the required funds to have their latrines emptied. Furthermore, the study disclosed that many areas in the study location have a high-water table, making it challenging to construct underground pit latrines. As an alternative, above-ground engineered designs are used, which can be problematic when construction materials are compromised, thus posing further desludging challenges. Contrary to reviewed literature, the study observed that a high-water table is a major contributing factor to reliance on unhygienic desludging. Due to the high-water table, water percolates into the pit, causing toilets to fill up quickly, especially during rainy seasons. Some houses are required to desludge every three months, making desludging a very costly service (Seleman et al., 2020).

Consistent with the above, the Netherlands Development Organisation (SNV, 2024) found that the risk associated with on-demand emptying of containment systems is that it typically occurs only when full or overflowing.

Introducing a scheduled desludging model means emptying occurs on a pre-agreed schedule, preventing overflows. An additional feature of the model is that it replaces traditional lump-sum payments for emptying services with a more affordable monthly payment scheme. This change made the service accessible to all income groups, with an agreed-upon two-year emptying cycle and a monthly fee of Zambian Kwacha (ZMW) 15 (EUR 0.67) that fully covers the service cost, replacing the lump sum of ZMW 550 (EUR 24) previously in place (SNV, 2024). With scheduled desludging implemented in the peri-urban area of Kamushanga, the uptake of scheduled emptying subscriptions grew rapidly, with 92% of the population subscribing. This widespread acceptance demonstrates that when suitable and economical solutions are available, there is significant demand for safe emptying services. The pivotal factor behind this success is increased affordability combined with reliable and professional service providers. The use of a scheduled desludging model in Kabwe can contribute to ensuring the financial sustainability of the utility.

The study revealed that most households in peri-urban areas do not plan for pit emptying; rather, once their pit latrines fill up, they are commonly buried and new ones constructed. This practice poses significant environmental and public health risks, particularly groundwater contamination, given that most residents rely on shallow wells for water. The infiltration of faecal matter into groundwater increases the risk of diarrheal diseases and other waterborne infections. Comparable findings are highlighted by Greene et al. (2021), who noted that in urban settings, pit latrines require periodic emptying due to limited space restricting the construction of new facilities. Furthermore, Strauss et al. (2000) and Thye et al. (2011) reiterate that pit latrines remain the predominant sanitation system among urban poor populations in many developing regions, especially informal and high-density settlements. In such environments, once latrines fill up, options for replacement are severely limited, making pit emptying the only feasible solution. Thus, safe and systematic management of full pits is crucial for sustaining sanitation access and protecting public health. The current study reinforces the argument that in peri-urban areas, where population density is high and reliance on shallow groundwater is common, failure to plan for pit emptying has direct implications for environmental health and disease prevention. This highlights the need for increased awareness, community engagement, and supportive regulatory mechanisms to promote the construction of emptiable toilet systems and the adoption of safe sludge management practices.

The study found that many households in peri-urban areas use pit latrines not only for human waste disposal but also as dumping sites for solid waste. This practice alters the texture and composition of faecal sludge, making it more difficult and costly to empty and treat. The presence of non-biodegradable materials such as plastics, rags, glass, and metal objects clogs emptying equipment and increases the labour required for manual removal. These challenges reduce the efficiency of faecal sludge management and pose significant occupational hazards for pit emptiers. These findings are consistent with existing literature. For example, Tomoi et al. (2025) observed that inappropriate household waste management practices significantly hinder safe pit emptying processes. Their study noted that households frequently dispose of solid waste such as “needles, bottles, and broken glass” into pits, accelerating pit fill-up, creating safety risks for emptiers, and obstructing pump-based emptying methods. Safe faecal sludge management is strongly influenced by household behaviour and awareness. The practice of using pit latrines as waste disposal sites is often linked to the absence of affordable and accessible solid waste collection services in informal settlements (Simiyu et al., 2017). Where such services are lacking, households adopt the latrine as a convenient alternative. However, as highlighted by Satterthwaite and Mitlin (2020), this coping mechanism undermines sanitation infrastructure and increases the cost and complexity of faecal sludge treatment. The current study therefore reinforces the importance of community sensitization on proper solid waste disposal and highlights the need for integrated sanitation and waste management strategies. Strengthening household awareness, improving waste collection services, and enforcing by-laws against disposing solid waste in latrines would reduce pit fill rates, protect emptiers’ safety, and enhance the sustainability of faecal sludge management systems.

The study revealed that willingness to pay for pit emptying services remains low among community beneficiaries. Despite the introduction of formal faecal sludge management services, many households continue to perceive pit emptying as costly and unaffordable, especially in contexts where incomes are unstable and livelihoods are informal. This unwillingness is compounded by financial constraints that make it difficult to plan for sanitation expenditures, particularly when sanitation is not prioritized compared to other immediate needs such as food, school fees, and household utilities. Additionally, the poor road network in most peri-urban areas presents a structural barrier, limiting accessibility for desludging trucks. As a result, residents face service delays or resort to informal pit emptying practices, including manual scooping or illegal dumping, which undermine public health and environmental protection efforts.

From a systems theory perspective, the issue of willingness to pay is not solely an economic limitation but reflects the interconnectedness of physical infrastructure, household capacity, service delivery models, and institutional coordination. The sanitation system extends beyond the household level to include road access planning (Lusaka City Council), regulation and monitoring (National Water Supply and Sanitation Council [NWASCO] and Zambia Environmental Management Agency [ZEMA]), service provision (Lusaka Water Supply and Sanitation Company

[LWSC]), and community governance structures such as Water and Sanitation Committees and Ward Development Committees. When any of these components are weak or misaligned, the entire sanitation chain is disrupted. For example, lack of road access prevents service provision, which in turn reinforces scepticism about the value of paying for sanitation services, thereby weakening compliance and willingness to invest in proper facility maintenance. This finding introduces a novel dimension to the discussion on urban sanitation. While existing literature often attributes low willingness to pay to lack of awareness or behaviour-related barriers, this study demonstrates that willingness to pay is shaped by a complex interaction of socio-economic pressures, infrastructural limitations, and perceptions of service reliability.

The study further revealed that employees involved in pit emptying services are required to undergo vaccination in accordance with the company's standard operating procedures. This requirement reflects an important occupational health safeguard, recognizing the inherent risks associated with contact with faecal sludge, including exposure to waterborne and communicable diseases. The emphasis on vaccination aligns with global best practices in faecal sludge management, which advocate for comprehensive health protection measures for sanitation workers.

From a systems theory perspective, this finding illustrates how sanitation service delivery depends not only on infrastructure and community compliance, but also on the capacity and well-being of frontline workers. The system operates through interconnected components—technical standards, operational procedures, worker safety measures, and regulatory oversight. Ensuring that sanitation workers are vaccinated strengthens the resilience of the sanitation system by maintaining workforce availability and reducing health-related service disruptions. However, the effectiveness of occupational safety depends on coordination between the utility company, the City Council Public Health Department, and national health institutions responsible for vaccination supplies and monitoring. Thus, this safety measure functions effectively only when institutional linkages are strong. This study adds a new dimension to the discourse on sanitation service delivery, drawing attention to the often-overlooked labour and occupational health component.

The study disclosed that many peri-urban areas are characterized by unplanned housing structures and narrow, irregular pathways, which make it difficult for service providers to access households when pit latrines fill up and require emptying. Poor spatial planning and high-density settlement patterns restrict the movement of vacuum trucks and other desludging equipment. As a result, households in these areas often depend on manual pit emptying or resort to unsafe practices such as abandoning filled pits or illegally discharging sludge into the environment. This situation limits the effectiveness of faecal sludge management services and increases the risk of environmental contamination and public health hazards. This finding is consistent with literature highlighting that many informal and peri-urban settlements develop without adherence to urban planning regulations. According to Jenkins et al. (2015), the lack of road access and structured plot layouts in informal settlements makes mechanical emptying either costly or physically impossible. Similarly, Simiyu et al. (2017) observed that sanitation access challenges are often compounded by the spatial arrangement of homes, where houses are built closely together, leaving no space for service vehicles to operate.

Moreover, the World Bank (2015) emphasizes that physical accessibility is a key determinant of sanitation service delivery under the Citywide Inclusive Sanitation (CWIS) framework. Where access is restricted, even well-designed policies and adequate service provision systems become ineffective. This reinforces the need for integrated urban planning and sanitation programming, where settlement layout, road networks, and drainage systems are considered alongside sanitation infrastructure development. Furthermore, another study revealed that accessibility—as observed by 18 studies—is a major factor influencing the choice of emptying method. Twelve of these studies discussed accessibility in terms of access to sanitation facilities, while ten discussed it in terms of availability of service providers. Accessibility negatively affects mechanical emptying, mainly in unplanned informal settlements with poor road conditions and narrow streets (Kennedy-Walker et al., 2015). Another problem is poor design and construction of containment facilities, which either have no or limited access for emptying, as some dwellers construct other structures on top of or too close to them (Holm et al., 2018). Although financial assistance is sometimes obtained through banks, thrift, or loans from relatives, accessing these funds is usually difficult, as banks, financial institutions, and private entrepreneurs are often unwilling to invest in the pit-emptying business (Opel et al., 2011).

The sanitation situation has been a growing concern for many stakeholders, including communities living in peri-urban areas. This situation has prompted service providers and policymakers to rethink sanitation solutions and strategies, particularly for pit emptying as and when facilities fill up. There are concerns about limited space for constructing new toilets and contamination of underground water due to the practice of burying latrines when they fill up. Most people in peri-urban areas do not have the financial capacity to pay for pit emptying, making it a low priority. To address this, the utility company adopted a pit emptying strategy that enables communities to make partial contributions towards desludging their pits when full. The flexibility of this payment model provides breathing space for most community stakeholders to have their pits emptied with minimal financial impact. Literature indicates that the lack of regulation leads to imbalanced competition among faecal sludge emptiers, as companies pay taxes, but individuals do not (Akumuntu et al., 2017). In Yaoundé, Cameroon, public authorities impose taxes at disposal sites, but the money collected is not reinvested in the system but rather used for personal gain. Additionally, there are no fixed

prices, as rates depend on the bargaining power of operators (Mougoue et al., 2012). In Nkobikok, Yaoundé, prices for emptying fluctuate due to undue obligatory or unofficial fees and bribes paid to officials by emptiers.

Furthermore, the study revealed that the introduction of scheduled desludging has improved predictability and affordability in pit emptying services. Under this system, households register their pit latrines and make small, routine contributions, enabling service providers to plan operations efficiently and reducing the risk of full pits overflowing or being emptied unsafely. This approach promotes household participation, accountability, and cost-sharing, fostering a sense of ownership and responsibility among community members. This finding aligns with global literature emphasizing that routine and scheduled pit emptying enhances the sustainability of on-site sanitation systems, particularly in peri-urban areas where informal settlements complicate service delivery (Strauss et al., 2000; Thye et al., 2011). Regular contributions by households make desludging services financially viable and reduce reliance on emergency or ad-hoc emptying, which is often more expensive and less safe. Therefore, scheduled desludging combined with active household participation ensures a more reliable, safe, and cost-effective approach to faecal sludge management. This strategy strengthens community engagement, supports formal service provision, and contributes to improved public health outcomes in peri-urban settlements.

The study found that the country has various sanitation laws, although most do not cover the initiative of scheduled desludging. This finding is consistent with Seleman et al. (2020), who noted that outdated laws with low penalties and lack of routine data are key contextual factors. Furthermore, the perceived inability to control unhygienic desludging among community members and the lack of shame among those performing unhygienic desludging are key psycho-social factors. Technological factors contributing to continued unhygienic desludging are linked to weaknesses in existing desludging technologies and general skepticism about the performance of manual desludging hand pumps (Seleman et al., 2020).

The Zambia Environmental Management Agency (ZEMA) enforces sanitation law through decision letter conditions issued to all facilities and routine compliance monitoring. However, the study revealed a lack of regular monitoring due to logistical challenges, consistent with findings from Uganda, which highlight the need for environmental regulators such as the National Environment Management Authority (NEMA) to enhance effective monitoring of service providers to ensure compliance with waste transportation regulations. With support from local leaders and community activation teams in each informal settlement, emptying schedules can be locally arranged, as was piloted with mobile transfer stations (Mawejje et al., 2018).

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

The study objective was to understand the scheduled desludging model for emptying pit latrines in Lusaka's peri-urban areas. The study adopted an Interpretive Hermeneutic Paradigm, in which knowledge was established through the Gadamer Hermeneutic Cycle, relying on iterations and fusion of horizons by merging the researcher's background with participants' views. Knowledge was further generated through co-construction, anchoring the study on a subjective epistemology. The researcher positioned himself as value-laden given the qualitative approach adopted, enabling awareness of both personal values and those of study participants. The researcher leaned heavily on interpretive phenomenology to gather stakeholders lived experiences. In view of the study objective, the study uncovers that scheduled desludging is a strategy that ensures predictable and affordable pit emptying. Households register their pit latrines and make small routine contributions. The study notes that the introduction of scheduled desludging enables community residents in peri-urban areas to easily empty pit latrines when they fill up. This strategy is being piloted in most peri-urban areas of Lusaka, Zambia. Moreover, scheduled desludging offers environmental and public health benefits, including prevention of pit latrines overflowing due to delayed emptying, which is typical in most peri-urban areas of Lusaka. Furthermore, the study reveals flexible payment arrangements that make it easier for community stakeholders to pay sanitation charges for pit emptying when full, rather than waiting until the pit fills up, which often makes it difficult for households to raise the required funds.

5.2 Recommendations

The study informs policy on strengthening the capacity of service providers to ensure timely and efficient desludging. It recommends strengthening environmental laws on licensing of effluent transporters to prevent open-air desludging, as current low penalties are not a sufficient deterrent to polluters. Lastly, Lusaka Water Supply and Sanitation Company (LWSC) should provide real-time responses to delayed service provision and regularly monitor online payment platforms for desludging.

Capacity building should be prioritized for staff to ensure buy-in for the piloting of scheduled desludging, especially for the on-site sanitation team and peri-urban zone leads. The utility company should also institute a

stakeholder engagement plan to reach out to community beneficiaries, community leaders, Ward Development Committees, faith-based organizations, and other community-based organizations.

Lusaka City Council should complement the utility company by facilitating the emptying of toilet facilities when needed, reviewing and updating existing memorandums of understanding with LWSC. This will help identify areas for collaborative efforts between the two institutions.

5.3 Ethical Consideration

The researcher conducted the study by ensuring the protection of human rights through guiding principles of dignity, integrity, right to self-determination, privacy, anonymity, beneficence, and confidentiality (Yip et al., 2016). Ethical issues were navigated by obtaining consent from the University of Zambia (UNZA), School of Humanities & Social Science Research Ethics Committee under the Directorate of Research and Post Graduate Studies (DGRS). Consent was also obtained from the institutions and community participants, who participated voluntarily and without coercion. Participants were provided with an information sheet outlining procedures for participation and withdrawal, thus highlighting potential risks.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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