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intervention

(ザンビア共和国ルサカにおける飲用水、サニテーション、衛生、廃棄物処理：参加型ア
クションリサーチによる評価と介入)

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ABSTRACT

The link between diarrheal disease and water, sanitation and hygiene (WASH) has placed access to improved WASH on the global priority list for decades. Whilst a problem categorized most prominently in the rural areas of low and middle income economies, rapid city migration and population growth have increased disease burden in the peri-urban where high density, inadequate structures and poor development hinder intervention. As diarrheal diseases are easily spread through common contamination points (higher risk in high density areas), effective intervention must run through from the individual to the broader community.

As a case in point, WASH factors are responsible for 11.4% of all deaths in Zambia, and yet despite annual waterborne disease outbreaks in the nation's peri-urban, few studies have been conducted to analyze and conceptualize peri-urban WASH for the creation of approaches suitable for the peri-urban. Through participatory action research, our study thus, worked with resident children and youth through the Dziko Langa Club, towards community-based assessment and intervention in peri-urban WASH, and subsequently, waste management. WASH and waste management is hereafter referred to as WASH&W.

Primary research sites were 2 peri-urban settlements in Lusaka City, Zambia (home to participating children and youth). A mixed method approach was used to (a) assess and conceptualize peri-urban WASH via ecological theory (photovoice and thematic analysis of 24 photographs and narratives from Dziko Langa youth); (b) identify specific factors influencing peri-urban WASH and diarrhea prevalence (logistical regression analysis of 205 household sociodemographic and WASH assessments); and (c) identify enablers and barriers to community intervention (thematic analysis of 11 community-based WASH&W management interventions conducted by the Dziko Langa Club).

Via ecological theory, thematic analysis defined peri-urban WASH as: (i) Poor practice (Intrapersonal, Interpersonal level); (ii) A health hazard (Community level); (iii) Substandard

and unregulated (Public Policy, Organizational); and (iv) Offering hope for change (Intrapersonal, Interpersonal). Linked to these themes, recommendations were aimed at policy development for capacity building, health promotion with increased weight towards community engagement and participation; infrastructure development and maintenance; and the implementation and activation of standards and regulations.

In line with these findings, multivariate stepwise logistic regression analysis of specific factors impacting peri-urban WASH highlighted the need for a holistic, simultaneous approach to WASH, and a separate WASH ladder for peri-urban (high-density) areas, bearing in mind their unique nature (e.g., limited space, communal facilities). Prioritizing the peri-urban label promotes plans towards inclusive WASH (i.e., communal finance, WASH education to help with choice and proper facility use to maximize benefit).

Finally, Dziko Langa Club interventions revealed a need for more collaborative, equal participation of local residents in WASH&W interventions; linking of policy makers (government) and peri-urban residents (intra/interpersonal) through community engagement (community). Additionally, systems supporting resident participation must be created and/or strengthened to reduce government burden and inversely, increase residents' participation in local WASH through empowerment, intervention and ownership of peri-urban WASH systems (development of socially acceptable value chains and services). Key findings from overall results and discussion were utilized to create a new approach suitable for community-based peri-urban WASH&W management intervention running throughout the peri-urban ecological model.

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CHAPTER I

BACKGROUND

Water, sanitation and hygiene (WASH) factors are responsible for 11.4% of all deaths in the Sub-Saharan nation of Zambia (UN Water, 2013). Since the 1990s, the nation has had diarrheal disease outbreaks annually (WHO, 2011), with only 67.7% and 40% of the population having access to improved drinking water and sanitation respectively (Central Statistical Office [CSO], 2016). That said, it is not surprising that neonatal, infant and under-five mortality rates which are also linked to diarrheal disease and poor WASH are high (at 24, 45, and 75 per 1,000 live births respectively) (CSO, Ministry of Health (MOH) & ICF International, 2014).

Diarrheal disease outbreaks have been found to primarily start in rural fishing villages and peri-urban settlements (more commonly referred to as ‘slums’) (WHO, 2011). Whilst there are several local and international approaches that have been developed to tackle rural WASH such as the WASH Education program (Ministry of Energy and Water Development, 2010; Lungu and Harvey, 2019) and Community Led Total Sanitation (CLTS) (Peal, Evans, & Voorden, 2010; Wilbur & Danquah, 2015; Bateman & Engel, 2018), studies focused on analyzing and conceptualizing peri-urban WASH with its unique features are lacking.

With over 60% of the Zambian population under the age of 25, our study thus, worked with resident peri-urban children and youth through a club called Dziko Langa (conceptualized for the purpose of participatory action research) (CSO, 2016). The aim was community-based

assessment and intervention in peri-urban WASH, and subsequently, waste management for the creation of approaches/methodologies suitable for holistic management and community engagement towards improving peri-urban WASH, and subsequently, peri-urban health. This first chapter will endeavor to introduce and breakdown key research components, namely: WASH and disease burden, waste management, peri-urban, WASH approaches and methodologies, and community engagement, giving clarity to the state of the problem. It will further, introduce the research area, theoretical framework and objectives of the study.

1.1 Water, sanitation, hygiene and disease burden

According to the World Health Organization (WHO), improvements in water, sanitation and hygiene (WASH) could result in a global disease burden reduction of as much as 10% (WHO, 2019). WASH is central to diseases caused by fecal-oral contamination such as diarrhea, cholera and typhoid (Morse, Tilley, Chidziwisano, Malolo, & Musaya, 2020). Approximately 2 billion people drink fecal-contaminated water, and 4.5 billion use a sanitation system that does not adequately protect them from fecal-human contact (WHO, 2019). Access to improved WASH has been found to prevent pathogen transmission through blocking fecal ingestion (drinking water), safely managing feces (sanitation), and handwashing with water and soap to kill pathogens (Morse et al., 2020; Naughton & Mihelcic, 2019; Tilley et al., 2014). This link between diarrheal disease and WASH has placed universal access to improved WASH on the global priority list for decades, currently being channeled through Sustainable Development

Goal (SDG) 6: clean water and sanitation (WHO, 2018; Prüss-Ustün et al., 2019).

In spite of progress towards universal access to improved WASH, several at risk groups have been identified as having difficulties in meeting planned SDG targets. Differences in residential area, e.g., urban vs. rural (Cha et al., 2017); socioeconomic, e.g., low-income vs. high-income (Andersson, Dickin, & Rosemarin, 2016); and individual characteristics, e.g., women vs. men (Cherunya, Ahlborg, & Tru, 2020; Kwiringira, Atekyereza, Niwagaba, & Günther, 2014) have been cited as factors responsible for these differences (WHO, 2019), with the later categories being at risk, or highlighting unique risk factors.

This comes alongside the realization that both hard (e.g., flush/pour toilets, sewers) and soft (e.g., CLTS, WASH Education) tailor fitted approaches and solutions are necessary to tackle the unique and varying global WASH circumstances (Peal, Evans, & Voorden, 2010). Picking on these geographic and socioeconomic disparities, this study primarily focused on developing suitable WASH intervention methodologies as a means of tackling disease burden in peri-urban settlements of the low-middle income nation of Zambia.

1.1.1 WASH service levels

Guidelines for categorization of WASH have been laid out in the WHO-UNICEF Joint Monitoring Program as service levels, with updated documents adding clarity and taking note of individual, socio-economic and geographical differences that need special inclusion (Organización Mundial de la Salud, 2018; WHO/UNICEF, 2019). Drinking water and

sanitation facilities are either categorized as improved (safely managed, basic and limited), or unimproved (unimproved and surface water/open defecation), and facility (facility with soap and water, and facility without soap and/or water), or no facility for hygiene, i.e., handwashing (WHO & UNICEF, 2017).

Households with access to piped water, boreholes or tube wells, protected dug wells, protected springs, and packaged or delivered water sources were categorized as having 'Improved' drinking water. 'Unimproved' drinking water was indicated by households that accessed water from unprotected sources (dug well or spring) and surface water (directly from a river, dam, lake, pond, stream, canal or irrigation canal).

For sanitation, improved facility status referred to flush/pour flush to piped sewer systems, septic tanks or pit latrines, ventilated improved pit latrines, composting toilets or pit latrines with slabs. 'Unimproved' facility referred to pit latrines without slab or platform, bucket latrines, and disposal of feces in fields, forests, bushes, open bodies of water or other open spaces, or with solid waste (WHO & UNICEF, 2017). It's important to note that only privately owned facilities were categorized as having safely managed drinking water and safely managed and basic sanitation at household level.

Lastly, having a handwashing facility, regardless of soap and/or water availability was categorized as 'Facility', whilst the absence of such facilities was categorized as 'No facility' (WHO & UNICEF, 2017). Facility sharing had no impact on the service level.

1.2 Waste Management

Researcher assessment of planned research sites (Nyambe, Hayashi, Zulu, & Yamauchi, 2018) and participant decision making during the study highlighted the importance of good solid waste management to WASH, particularly in the peri-urban. Despite poor waste management commonly taking a back seat in the narrative of fecal-oral contamination, a number of studies have cited it as a culprit (Kapata et al., 2018). Solid waste management meets with WASH in SDG 1: No poverty, which calls for universal access to basic services; water, sanitation, hygiene and solid waste management are within 3 of 6 physically visible services targeted.

To mention a few, poor solid waste management has been responsible for blocked water boreholes, drainages and subsequent flooding (allowing for stagnant water and breeding of pathogens), and blocked toilets and pit latrines (causing fecal seepage and failure of fecal sludge removal). With poor access to water and no sewer lines running through houses, drinking water from wells and boreholes is often contaminated through pit latrines and poorly disposed and untreated waste (UN-Habitat 2010: Ch.1). With an increased accesses to products and limited service provision, waste management is a serious problem in the peri-urban.

1.3 Peri-urban

A major contributor to the challenge of access to clean water and sanitation is the increase in peri-urban settlements. The peri-urban or ‘slum’, is described as “...a wide range of low-income settlements and/or poor human living conditions... [or]... a heavily populated urban area

characterized by substandard housing and squalor” (UN Habitat, 2010:10).

Globally, over 1 billion people live in peri-urban communities; and the numbers are expected to increase. It is reported that Africa has the highest degree of peri-urban growth at an annual rate of 3.5% (Mo Ibrahim, 2015), with 80% of the urban population living in the peri-urban (Water Aid, 2008). Very few national surveys on WASH routinely distinguish peri-urban settlements amongst their rural and urban counterparts (WHO/UNICEF, 2019). This means that information on peri-urban WASH is scant, creating a gap in the urban WASH story. This gap is also partly credited for the uneven WASH achievement amongst this demographic on a global scale.

1.3.1 The case of Lusaka, Zambia

Text excerpts from: Nyambe, S., Hayashi, K., Zulu, J., & Yamauchi, T. (2018). Water, Sanitation, Hygiene, Health and Civic Participation of Children and Youth in Peri-Urban Communities: An Overview of Lusaka, Zambia. Sanitation Value Chain, Vol. 2(01), 39–054, 2018. <https://doi.org/svc.00010>

Zambia is a low-middle income nation in Sub-Saharan Africa with a population of approximately 15.5 million. Only 67.7% and 40% of the population have access to improved drinking water and sanitation respectively (CSO, 2016). In comparison to national statistics, peri-urban figures reveal that approximately 56% and as much as 90% of the peri-urban population lack access to safe water and sanitation facilities respectively (International Monetary Fund, 2006). Poor WASH has also been linked to the nations annual cholera

outbreaks which usually emanate from rural fishing villages and peri-urban settlements (WHO, 2011). Neonatal, infant and under-five mortality rates are quite high (at 24, 45, and 75 per 1,000 live births respectively) (CSO, Ministry of Health (MOH) & ICF International, 2014). Even so, the country has a youthful population, with approximately 65% being under the age of 25 years, and the majority of household heads falling in the age bracket of 18-29 years (CSO, 2016).

In Lusaka, Zambia's capital city, national statistics indicate that approximately 70% of its residents live in the peri-urban (CSO, 2012). The city is home to 37 peri-urban settlements (CSO, 2016) which are concurrently affected by the challenge of poor WASH and health care. During the 2017/2018 rain season, an outbreak of cholera emanating from Lusaka peri-urban resulted in 5,905 registered suspected cases; the majority (91.7%) were from within Lusaka, with the outbreak spreading to 7 of 10 Zambian provinces (Kapata et al., 2018). Research found that the outbreak was caused primarily by fecal contamination of food and water (Kapata et al., 2018).

As unplanned and initially unauthorized settlements, the peri-urban has limited access to social and physical infrastructure, and utilities, e.g., schools and health facilities, water supply, electricity, roads and security services. The majority of Lusaka's unplanned settlements were created during colonial times as "early self-help housing" and "unauthorized housing" due to African urban employment and rural-urban migration (Mulenga, 2003; Yasini, 2007). As of 1974 however, the Zambian government moved to change the status of several of these

communities from illegal unplanned settlements to improvement areas (the latter terminology used for those that have attained legal status, government provision of social and physical infrastructure and title deeds to residents). Improvements in service and utility developments are however, slow (Mulenga 2003).

The peri-urban structure was organized under wards, which were divided into smaller zones within the land boundaries of the settlement area. Each zone elects 2 members to hold position within the Ward Development Committee at community level, and 1 councilor at government level. The key aims of the committee are to push forward community development, with the councilor being their first level government representative (Yasini, 2007).

Of Lusaka's 37 peri-urban settlements, 9 were assessed for the purpose of the study from August to October 2016; preliminary research was conducted in 3 of 9 settlements and finally, 2 settlements were selected as research sites for the overall research.

1.4 WASH approaches and methodologies

In a bid to solve the challenges of poor WASH, organizations, researchers and governments have sought to increase people's access to WASH facilities (hardware). Some examples of hygiene and sanitation hardware are toilets, pipes, sewers, taps, soap and ancillaries such as pit-emptying equipment (Peal, Evans, & Voorden, 2010). Hardware however, has proved to be expensive (Satterthwaite et. al, 2015), and at times, rejected and discarded by targeted populations in need due to varying sociocultural and economic factors amongst others (Kumar

& Vollmer, 2013; Keiringira et. al, 2014).

As a needed complementary, software (hereinafter referred to as an ‘approach’) is defined as hygiene and/or sanitation promotional activities that allows a program, project or intervention to take place. These include policy development, training, monitoring and evaluation. Effective WASH approaches should therefore, empower individuals and communities with knowledge, enable a change in behavior, create demand for services, facilitate establishment of supply chains, and/or improve the planning and implementation of hygiene and sanitation projects in consideration of socio-cultural factors (Peal, Evans, & Voorden, 2010).

In their book titled ‘Hygiene and Sanitation Software: An overview of approaches’, Peal, Evans, & Voorden (2010) cite and outline 25 WASH approaches spanning a period of about 4 decades. The outlined approaches covered Hygiene Promotion (Participatory Hygiene and Sanitation Transformation [PHAST], WASH in Schools, Child-to-Child, etc.), Sanitation Promotion (Community Led Total Sanitation [CLTS], SaniMarts, Sulabh, etc.), Participatory Planning (Participatory Rural Appraisal [PRA], Methodology for Participatory Assessment, etc.) and Programming Frameworks (Sanitation 21, Household-Centered Environmental Sanitation [HCES], etc.).

Similar to WHO and UNICEF (2019) findings, the authors noted a bias in favor of rural rather than urban WASH approaches, citing a perception that interveners found the rural challenge easier to address. With rising urbanization, they make a point for the need for good, well-

documented at-scale examples of urban programs that resolve WASH issues across the sector (Peal, Evans, & Voorden, 2010).

In Zambia, several studies have been conducted to assess WASH approaches (Bresee, Caruso, Sales, Lupele, & Freeman, 2016; Chikwanu, 2014; Joshi, Kooy, & van den Ouden, 2016; Lawrence et al., 2016; Tidwell et al., 2019). The majority of approaches working with community members on sensitization, awareness, implementation and behavior change focus on household heads and community leader participation as financiers and decision makers, e.g., CLTS has been used primarily in rural communities to combat open defecation by encouraging whole communities to construct their own latrines (Peal et al., 2010; Wilbur & Danquah, 2015).

In relation to Zambia, it is important to bear in mind however, that the older age bracket makes up less than 50% of the population. Fortunately, there are programs focused on children and youth participation such as School Led Total Sanitation (SLTS) primarily in rural communities and Water, Sanitation and Hygiene Education (WASHE) programs in schools. SLTS is one of the approaches used in WASHE in school programming. Similar to SLTS, it focuses on open defecation and improved hygiene and sanitation facilities in the school on the premise that the behavior change in the children and improvements within the school will have an impact on home and community sanitation (UNICEF & UK Aid, 2014).

Amongst many positives of the SLTS approach, Peal et. al. (2010) state that one of the downsides to it is its requirement for high teacher involvement and time (Chikwanu, 2014; Joshi

et al., 2016). As with many programs involving children and youth, their success is highly dependent on adult supervision and leadership. Of the twenty (20) approaches outlined in their book, 'Hygiene and Sanitation Software: An overview of approaches', eight (8) of them involved children of which three (3) were linked to the school system.

A deeper analysis of these programs reveals that programs involving children and youth focus on educating them (e.g., Child Hygiene and Sanitation Training, Community Health Clubs), peer education (e.g., Community Health Clubs, Child-to-Child) and assisting with children needs (e.g., Foam and SaniFoam, Hygiene Improvement Framework). School based programming also has a high focus on action within the school with school authorities taking a high leadership role (e.g., WASH in Schools, SLTS). There is opportunity for child and youth impact on the broader community in several of these programs. It is however, not always the sole focus of the program frameworks. Furthermore, several of these programs are only rural based and/or not conducted in Zambia (Peal et. al., 2010; UNICEF & UK Aid, 2014). The only program mentioned as conducted in urban Zambia involving children was WASH in schools.

1.5 Community participation (children and youth)

Community participation can be defined as '...the involvement of people in a community to solve their own problems.' (Harvey, Baghri, & Reed, 2002: 177). Kearnes et. al. cited two definitions of 'Civic participation' or 'Civic Engagement':

‘...individual or collective actions in which people participate to improve

the well-being of communities or society in general, and which provide opportunities for reflection’... [and]... an expression of young people as social actors, and the contributions they already make in society or in their ‘practices as citizens’. (2012:3)

Civic participation runs across all age groups and depicts the involvement of a citizenry within the running and occurrences of its society. Research has shown that there is a link between civic participation and an effective, well-functioning public sector (Reuben & Levy-Benítez, 2003). When children and youth are added to this equation, it offers an opportunity for learning, development and creativity that moves into adulthood, developing the foundation for sustainability.

In offering recommendations based on his study which was focused towards effective and holistic participatory communication strategies, Habulembe (2013) indicated the need for the active involvement of the affected audience. This would ensure that the target gained knowledge, became actively involved in prevention, took ownership of and created more sustainable programs. Pertaining to WASH, children and youth are active participants at household level, often responsible for water collection, toilet cleaning and even care of younger siblings (Lancy, 2016; IYF, 2014; Hemson, 2007). In agreement with this, children and youth have been participants and key actors in WASH and health research (Kim, 2016; Tsang, Fletcher, Thompson, & Smith, 2020; C. C. Wang, 2006). Even so, they are often marginalized and

therefore, often regarded as an at risk group (Sphere Association, 2018).

When it comes to child-youth participation, marginalization or social exclusion has been a long-term matter of contention. Social exclusion refers to the:

“...process by which certain groups are systematically disadvantaged because they are discriminated against on the basis of their ethnicity, race, religion, sexual orientation, caste, descent, gender, age, disability, HIV status, migrant status or where they live.” (Khan, 2012:4).

In the case of children and youth, the social exclusion is primarily based on age and income, covering such aspects as decision making, political voice, community participation, information and human rights (Paolini & Coutinho, 2013; Columbia Global Policy Initiative, 2014).

Zambia’s 2010 census statistics indicated that 45.4% of the population were aged below 15 years and 20.8% between 15-24 years (CSO, 2012). This places more than half of the nation’s population (66.2 %) at under 25 years of age (CSO, 2012). Despite this high youthful population, young people are generally marginalized in Zambia, with young people being underestimated as change agents. As such, levels of youth participation remain low (International Youth Foundation, 2014).

In a baseline study conducted by Restless Development in Central and Copperbelt provinces of Zambia, results showed that 77% of youth interviewees had never been involved in any community development initiative or work. Reasons indicated were lack of information, lack

of opportunity for participation and poor education (International Youth Foundation, 2014).

Social exclusion of youth has been linked to problems in “...the living conditions, social and economic participation, emotional life and health status of young people.” (Paolini & Coutinho, 2013: 4).

With the increased focus on sustainability for achievement of SDGs, emphasis has been placed on the important position of children and youth in the sought after global success. Article 51 in September 25, 2015 resolution which established the SDGs states:

Children and young women and men are critical agents of change [emphasis mine] and will find in the new Goals a platform to channel their infinite capacities for activism into the creation of a better world. (United Nations General Assembly Resolution, 2015:12).

As such, the study focused on sustainability through community engagement of peri-urban children and youth as key participants, with the ability to use their knowledge and experiences to have an impact on and further engage the broader community.

1.5.1 Participatory Action Research

For the purpose of assessing and intervening in peri-urban WASH with the participation of local children and youth, the study was conducted as Participatory Action Research (PAR). Action Research can simply be defined as “a process of systematic inquiry that seeks to improve social

issues affecting the lives of everyday people.” (Hine, 2013: 151). A consistently developing research method, the process involves repeated cycles of planning, observing, and reflecting in which individuals and groups engaged in action research can implement changes required for social improvement. In recent past, this process has also incorporated children and young people as not only research subjects, but active participants and even researchers in their own right (cf. Kim, 2016; Foster-Fishman, Law, Lichty et. al., 2010; Suleiman, Soleimanpour & London, 2006; Hart, 2002).

The terms Participatory Action Research (PAR) and Youth Participatory Action Research (YPAR) have thus become more common in reference to such studies due to researchers identification of children and youth as resources for participatory action and research, gaining ground on preventive and positive developmental movements. That is, not only do they empower the young participants themselves through their incorporation and building on their intrinsic strengths, but they also create an opportunity for these young people to impact the broader community through their involvement in challenges that they themselves face (Foster-Fishman et.al, 2010; Wong, Zimmerman & Parker, 2010; Hart, 2002).

Previous YPAR researchers (Foster-Fishman et.al, 2010) have emphasized the importance of developing child and youth friendly research methods that could effectively tap into the wisdom of participants. Data collection and analysis methods were made to incorporate more active learning and participatory approaches, and imitate well known children’s games and activities

that were very easy for the participants to fully engage in.

A common theme pertaining to participation of younger persons is level of control, experience and in that line, their ability to successfully conduct such projects based on their varying levels of development. Wong et. al (2010) developed an empowerment framework, giving a breakdown of youth-adult participation due to the link and power play between adults, children and youth in such programs. They cited a pluralistic form of partnership as the most beneficial towards empowerment and success in youth-adult partnerships in which youth and adults share control, with children and youth having both voice and active participant roles. Pluralistic participation allows for both parties to draw on their strengths towards success and progress, e.g., the experience of adults and the innovativeness of children and youth. This allows for role modelling, confidence building, a sense of ownership and the improvement of strengths.

This sensitivity to differences, strengths and weakness in program design and implementation has proved to have an effect on the impact and acceptance of project activities and outputs by the broader community. In the study conducted by Foster-Fishman et. al. (2010), findings indicated that there was increased community and local organization encouragement towards engagement of its younger citizens, taking steps to improve means of their incorporation and participation, mainly due to ease of the program design. There was also an empowerment of the young people who participated, with participants conducting an in-depth analysis of data and offering viable recommendations for action (Foster-Fishman et. al., 2010).

1.5.2 Dziko Langa Club

For its purposes, the study developed a club called Dziko Langa (DL) meaning ‘My Community/Country’ in the local lingua (Nyanja language). DL acted as a framework and platform to incorporate children and youth as co-researchers and frontrunners on WASH in their peri-urban communities. Through DL, members were empowered with awareness, knowledge and skills to help them tap into their potential as community influencers and change makers. Additionally, DL offered members an opportunity to share their knowledge, expertise and solutions towards improving the status of peri-urban WASH and waste (hereinafter referred to as WASH&W) management.

In relating the literature to the overall study, DL acted as a vessel in which PAR was facilitated. As such, child-youth friendly research designs and activities were utilized to allow their participation in data collection and analysis. This was done to help members develop critical consciousness, create self and community awareness, gain community feedback and come up with possible interventions towards alleviating these community challenges.

DL members were children (10-14 years old) and youth (18-24 years old) from two (2) peri-urban settlements in Lusaka. Selected settlements were 2 of 9 assessed for the study within Lusaka District. They were selected based on availability of a local health center, youth center, school and recommendation from local research partners at the University of Zambia. All participation was voluntary and informed consent was required from participants and parents

(for child participants). During the course of the 3 year study, DL active children membership has been $n \approx 80$; and youth membership, $n \approx 40$.

1.6 Theoretical framework of the study

As much as WASH access and subsequent disease burden is commonly assessed at an individual and household level, access to WASH is also an issue in public institutions (e.g., schools, prisons), and is highly impacted by higher level policy and regulation which create an environment determining quality of access. To be thorough, peri-urban WASH, like waste management, should be assessed through the lens of these varying levels for the creation of a healthy WASH&W ecosystem.

The study therefore employed the Ecological Theory for the framework of the study. McLeroy and Bibeau (1988) suggested the ecological model as a means of understanding individual and social environmental factors as targets for health promotion intervention, breaking down behavior impacts into: (i) intrapersonal (an individual's knowledge, attitudes, behaviors, skills and their developmental history); (ii) interpersonal (family, friends, peers, immediate environment); (iii) organizational (rules, regulations and structures of schools, health centers, work places, etc.); (iv) Community (norms, values, organizational interactions); and (v) Public Policy (policy, procedure, law).

Regarding WASH&W management, these look at knowledge, attitudes and practices (intrapersonal level), household and neighborhood choice of and access to WASH and proper

waste disposal (interpersonal level), WASH&W disposal access, rules and regulations in schools, health centers and work places (organizational), peri-urban WASH&W norms and values (community level), and government and international policies defining, promoting and supporting universal access to improved WASH&W management inclusive of SDG 6 and 1.4.1 (public policy level). In addition to activities within individual levels is the interactions between them; a functioning model should allow for policy to easily impact individual lives and vice versa for the achievement of universal WASH&W management access. The study sought to assess these levels and interactions to create a case and strategy for the planned new WASH&W approach.

1.7 Statement of the problem

The link between WASH, waste management and disease burden is evident. Diarrheal diseases are both treatable and preventable. Despite this, Lusaka Zambia experiences yearly disease outbreaks which often emanate from its peri-urban settlements. Although access to improved WASH is higher in the urban/peri-urban residential space than its rural counterpart, frequent outbreaks in the peri-urban are a major concern due to its rising population. Moreover, hardware improvements to peri-urban WASH are expensive with its high population density and general lack of municipal provisions and services. Limited peri-urban software and poor community engagement have been linked towards the rejection of several developed solutions and strategies for peri-urban WASH. Moreover, very little has been done to ensure that large

sidelined groups (e.g., children and youth) are not left behind to ensure more inclusive, sustainable intervention.

1.8 Objectives of the study

The main objective of the study was to breakdown and assess peri-urban WASH&W management in Lusaka, Zambia for the purpose of creating a framework for meaningful community participation (intervention) with local young people taking an active role. To do this, the specific research objectives were to:

- (i) Work with young locals to identify factors defining peri-urban WASH and analyze the peri-urban WASH ecosystem via ecological theory;
- (ii) identify specific factors influencing peri-urban WASH and diarrhea prevalence at intra- and interpersonal levels;
- (iii) identify barriers and enablers to community intervention in peri-urban WASH&W management; and
- (iv) use cumulative findings to develop a new approach suitable for Lusaka peri-urban WASH&W intervention involving all actors (primarily young people).

1.9 Compliance with ethical standards

Prior to the commencement of the study, all processes, documentation and data collection tools underwent ethical screening, and were approved by ERES Converge Ethical Approval Board, Lusaka (Ref. No. 2017-Mar-012) and the Faculty of Health Sciences, Hokkaido University,

Japan (Ref. No. 16-103). Signed informed consent was required from all participants who were ≥ 18 years of age, and signed informed assent and parental consent was required from all participants who were < 18 years of age. Furthermore, all participation was voluntary and participants could freely withdraw prior to completion of the study. The research was conducted under the Sanitation Value Chain Project, registered with the Research Institute for Humanity and Nature based in Kyoto, Japan. The study design, data collection, analysis, article and all other aspects related to the research were fully under the discretion of the researchers.

CHAPTER II

PERI-URBAN WASH&W MANAGEMENT IN LUSAKA, ZAMBIA:

PHOTOVOICE EMPOWERING LOCAL ASSESSMENT VIA

ECOLOGICAL THEORY

(Nyambe S, Yamauchi T. Peri-Urban Water, Sanitation & Hygiene in Lusaka, Zambia: Photovoice empowering local assessment via ecological theory. Submitted to Global Health Promotion; Under Review)

2.1 Methodology

Study objectives were to (a) understand current peri-urban WASH, analyzing its barriers and enablers; and (b) discuss possible solutions to presented challenges (recommendations). The primary research method was photovoice, a participatory method in which cameras are given

to individuals often excluded from decision-making processes in order to capture their voices and visions of their lives and their community (Wang, 2006). Though relatively new to the WASH sector, the photovoice methodology has been found useful for identifying new, unique priorities in WASH, and encouraging community participation in project planning and engagement (Davis, Javernick-Will and Cook, 2018). Photovoice was suitable as an easy, affordable, reliable and low skill requiring data collection method. The photovoice process was in 2 parts: (i) data collection through taking of photographs; and (ii) sharing of narratives and subsequent discussion with other participants.

2.1.1 The photovoice exercise process

The study was conducted in December 2017. The first part of the photovoice process was conducted with a total of 12 DL youth members aged 17-24 years of age [(n) Males = 7, Female = 5] who took part in taking photographs within their residential areas. Participation in the exercise was based on participant availability. Prior to data collection, participants had brief training on usage of digital cameras and were instructed on ethics as researchers, e.g., informed consent when taking photographs. Participants were then given 4 days in which to each take 2-5 pictures to help them answer the framing question: ‘What is WASH in your community?’ All photographs taken (N=65) were handed over to the researcher. Participants were then requested to select 2 photographs to be printed out and used for subsequent discussions (contextualization). A total of 16 youth (17-24 years of age) [(n) Males = 10, Female = 6] separated into 5 groups

of 3 (one group had 4 participants) took part in data interpretation. The following process was used (Wang and Burris, 1997):

1. Contextualization (photograph narratives): Explanation of why and where the photographs were taken, and the key variables to be noted in the storyline.
2. Contextualization discussion: (i) Do participants agree with the presented subject?; (ii) why is it a challenge?; (iii) what aspects are responsible for/linked to the aforementioned challenge?; and (iv) what possible solutions can be implemented to curb the challenge?
3. Poster Creation for summation of findings: 6 minute poster presentations and 8 minute question and answer session per presentation.

2.1.2 Data analysis

The researcher drew on Maguire & Delahunt's (2017) practical guide on thematic analysis for photovoice analysis. In thematic analysis, patterns and themes are identified in qualitative data.

As such, the narratives rather than the photographs, were analyzed. Photographs were primarily considered as supporting pieces to narratives. The final themes had to give clear, concise answer to the framing question, 'What is WASH in your community?' Participant findings and recommendations were then analyzed via ecological theory.

2.2. Results

Figure 1 shows participant selected photographs (N = 24). Their corresponding narratives are in Table 1.



Fig 1: Photovoice photographs (numbered by group)

Table 1: Summary of photovoice narratives by group (refer to Figure 1)

Photo	Photograph Narratives
1	a) It's not good to have this type of toilet. We need good toilets. The toilet is not built. It does not have a roof, wall, door and floor. It's dirty and the toilet hole has no cover. There's also no handwashing station. b) The location of the dumpsite is not OK because the area is surrounded by houses. Children play near and at the dump site. Due to this scenario, people around the community get sick often. It's not safe for residents c) Always keep your tap clean, not like this d) We should keep our homes clean like this. A clean home is a clean nation.
2	a) Children are playing on the wet ground, scrubbing it with their fingers and hands b) Drainages are blocked with garbage due to people's ignorance on where to dump garbage c) Water pipes are close to the surface of the ground. Plastic pipes are easily damaged. The man is not a worker for Lusaka Water and Sewerage Company (LWSC). He doesn't have correct equipment or safety wear. He risks polluting water with the plastic bags used to tie the pipes d) Contaminated surface water will affect underground water if pipes are damaged e) No proper equipment for waste separation. The burning of garbage causes air pollution to nearby houses f) Water and wind carries away plastic materials from our communities into drainages. The council are not cleaning up on time
3	a) Poor drainage systems. Turning of drainages into dump sites b) Poor waste management. No legal dumping sites due to poor policies, personal interests and lack of knowledge c) These people fetch water from this tap every time. The water source area is not clean. They are cleaning their water buckets with soap, but we don't know if the water is safe or not (poor water supply and infrastructure). d) Poor toilet structures in public institutions create health hazards
4	a) There is a bin near the door. There's a smell and there are flies going into the house. People who are eating the other side can get diseases b) There's a bin near the window. It's possible for someone to get a disease like cholera, typhoid and TB due to the smell coming from the waste [The narrator said she was not sure if it's true] c) The drainage is filled up with bottles, plastic and sand

	d) There's a tap with running water behind the girl. She however, is washing the bucket with dirty water on the ground which is stagnant and contaminated. e) This open dumping site is near the houses f) This is a poor toilet. There are some feces on the surface, the structure is not well built and the slab is not in good condition
5	a) Stagnant waters (dam) [The dam is in the vicinity of the image. 5ax shows a similar dam]: The same water is used for washing, dumping site for residents, people urinate in the water, children swim and play b) Local dumping site (illegal) c) The house has a bin right next to the door and a dirty drainage d) The household and yard are clean. The household owner has good sanitation qualities

2.2.1. Thematic Analysis Results: What is WASH in your community (Peri-urban WASH)?

2.2.1.1. Peri-urban WASH is Poor Practice (PP)

Within PP, participants describe WASH practices done out of habit, ignorance and lack of facilities creating two sub-themes: 'Unsanitary' (see Figure 1 and table 1: 1a, c; 2b, e; 4a, b, c, d; 5c) and 'Lack of Facilities' (see Figure 1 and table 1: 1a, b; 2b; 3a, b; 4c; 5a, b). Participants highlighted limited access to quality WASH facilities as causal for PP (lack of fully accessible local taps, legal dumping leading to use of dormant land/spaces for waste disposal, and limited toilet access - primarily shared, outdoor or lacking leading to open defecation). Poor knowledge and hygiene awareness meant few/limited preventative measures, e.g., poor sorting, recycling and safe waste disposal practices.

2.2.1.2 Peri-urban WASH is a Health Hazard (HH)

Contamination routes highlighted environmental cleanliness, hygienic maintenance, location of WASH facilities and child safety in this theme represented by Figure 1 and table 1: 1a, b, c; 2a, b, c; 3a, b; 4a, b, c, d; and 5a, ax, b, c. Limited access to quality WASH facilities caused contamination through unregulated multipurpose usage (i.e., water sources for dump sites, toilets, recreation facilities; dumpsites for toilets, recreation facilities), created accessible illegal/contaminated facilities (i.e., dumpsites near households, makeshift toilets), and caused overuse and/or poor maintenance of existing facilities (e.g., public toilets). Secondly, habitual poor practice maintained ignorance creating a health hazard norm through ease of poor practice. Lastly, lack of WASH standards and regulations (e.g., toilet standards, waste collection) created and facilitated health hazards.

2.2.1.3 Peri-urban WASH is Substandard and Unregulated (SU)

Sub-themes were standards (see Figure 1 and table 1: 1a; 2c, e; 3a, c, d), regulations (see Figure 1 and table 1: 1b; 2c, e; 5a) and malpractice (see Figure 1 and table 1: 2f; 3b). Participants registered a lack of and ignorance on WASH infrastructure standards on toilet and water sources: Residents lacked guidelines on quality and use of wells, flush toilets, etc.; and were unaware of recommended infrastructure materials and standards for installation to avoid contamination and protect users. They also complained of poor adherence and/or consequence for ignoring standards and regulations, or malpractice (e.g., for bad waste disposal practice,

tampering with public WASH facilities, etc.), with a failure/inability to report malpractice. Lastly, participants reported overuse, misuse and limited to no maintenance of WASH facilities (poor/no regulation). Their communities had several unattended to faulty public taps, congested drainages, misused water sources and blocked toilets. Furthermore, it was common for non-authorized persons to do maintenance on public WASH facilities.

2.2.1.4 Peri-urban WASH Offers Hope for Change (HC)

Good WASH practices that offered hope for change and improvement were expressed in Figure 1-1d & 5d (refer to corresponding narratives in Table 1). Rather than challenges, participants pinpointed promoting factors for the positive household condition: (i) That the household was well managed; and (ii) That the household owner had put in place (created a pattern for) good sanitation habits.

2.2.1.5 Summary of Thematic Analysis: What is Peri-Urban WASH?

Figure 2 gives a summation of thematic analysis linking the above themes and indicating, based on participant discussion, how themes made an impact on the peri-urban via ecological theory.

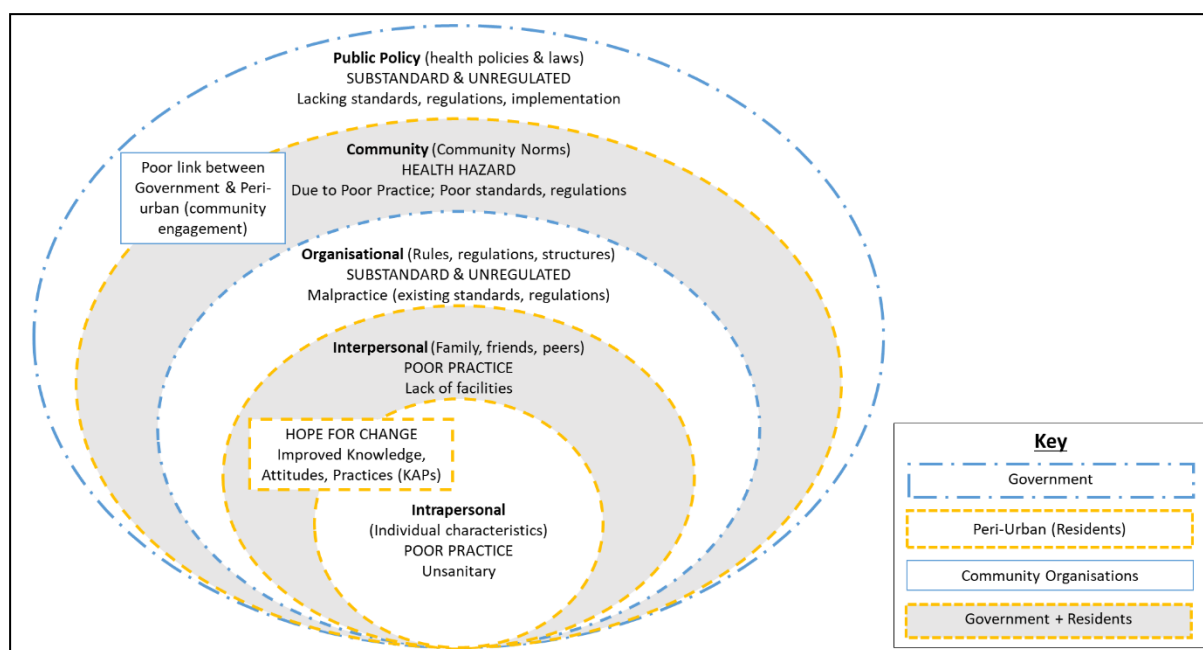


Fig. 2: Summary of thematic analysis defining peri-urban WASH via Ecological Theory

2.2.2. Recommendations for Peri-urban WASH

Table 2 gives participant recommendations to challenges, whilst figure 3 details their analysis across stakeholders within and outside the peri-urban via ecological theory.

Table 2: Participant Recommendations to WASH Stakeholders

Directed to	Recommendations
Government	- Establish and implement policies: - Registration of water maintenance and setup personnel (to have correct equipment and safety certificates) - Education of communities on importance of good sanitation and proper handwashing practices <i>Engagement of communities in sanitation activities (form sanitation centered groups/clubs)</i> - Invest in peri-urban infrastructure development (ensure no one is left out): - Recreation: Construct safe playgrounds and swimming pools in dam areas - Setup mobile toilets for low income communities

Directed to	Recommendations
	2.3. <i>Install peri-urban accessible and affordable waste bins and dump sites in key areas and bury illegal sites. Charge at disposal.</i> 2.4. Construction and maintenance of well-structured water and drainage facilities (treated public water sources), e.g., pre-paid taps 3. Enforce the law on: 3.1. Poor waste disposal (ensure public spaces/drainages are clean) 3.2. Toilet construction standards and ownership regulation (One house, one toilet) 4. Regulate: 4.1. Water sources, particularly public/private wells 4.2. Verify and recommend dependable waste collectors 4.3. <i>Educate residents and waste collectors on proper waste management (sorting, disposal, treatment)</i>
Peri-urban Residents	5. Hold water authorities accountable for poor maintenance (awareness) 6. Stricter toilet maintenance required by landlords/home owners (usually responsible for shared toilets) 7. Create community gardens on dumpsites 8. Make sure children play in a dry and safe place
DL (youth participants)	9. <i>Education:</i> 9.1. <i>Maintenance of WASH facilities, e.g., keeping the tap clean</i> 9.2. <i>Dangers of using untreated water</i> 9.3. <i>Importance of good sanitation, cleanliness, hygiene and care/management practices (toilet cleaning, handwashing stations, etc.)</i> 9.4. <i>Encourage recycling (remind residents that garbage is money)</i> 9.5. <i>Incentivize positive efforts by residents through taking pictures to create peri-urban WASH success models</i> 10. Clean-ups: 10.1. Public taps 10.2. <i>Conduct public cleaning in markets, hospitals, schools, roads, etc.</i> 10.3. <i>Government should help DL with a vehicle for transfer of waste (small business development)</i> 11. Engagement 11.1. <i>Stakeholders (government, communities, other) in DL sanitation activities</i> 11.2. <i>Incorporate residents in cleaning activities</i>

**Text in Italics: Activities selected by DL (youth participants) for intervention*

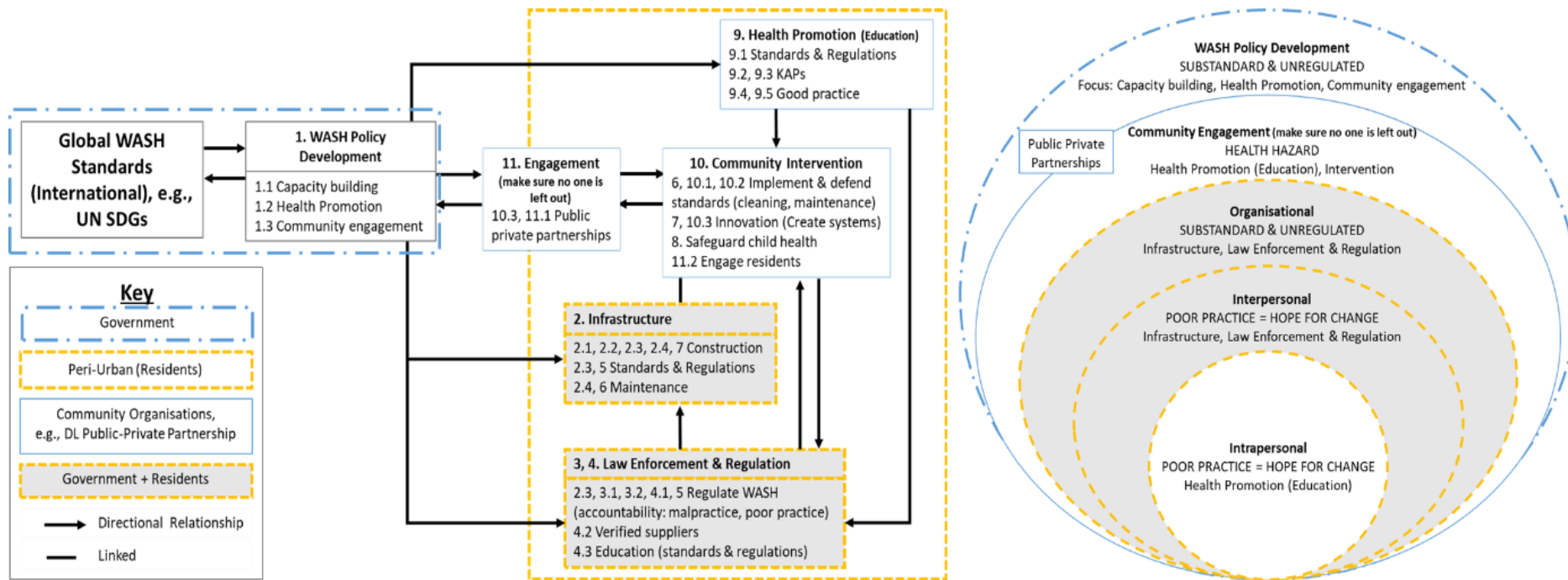


Fig. 3: Participant recommendation analysis (refer to Table 2) and summary via ecological theory

CHAPTER III

SOCIODEMOGRAPHIC AND WASH FACTORS INFLUENCING DIARRHOEA PREVALENCE IN A PERI-URBAN SETTLEMENT OF LUSAKA, ZAMBIA

(Nyambe S, Agestika L, Yamauchi T (2020) The improved and the unimproved: Factors influencing sanitation and diarrhea in a peri-urban settlement of Lusaka, Zambia, PLoS ONE, 15(5):e0232763. <https://doi.org/10.1371/journal.pone.0232763>)

3.1 Methodology

The study used an exploratory cross-sectional design, with data collected between September and October, 2018. A brief breakdown of research site selection and sampling procedure is given in Figure 4. A questionnaire and observation checklist were used for data collection, and findings were analyzed using multivariate logistical regression. The following is a detailed description of the research process.

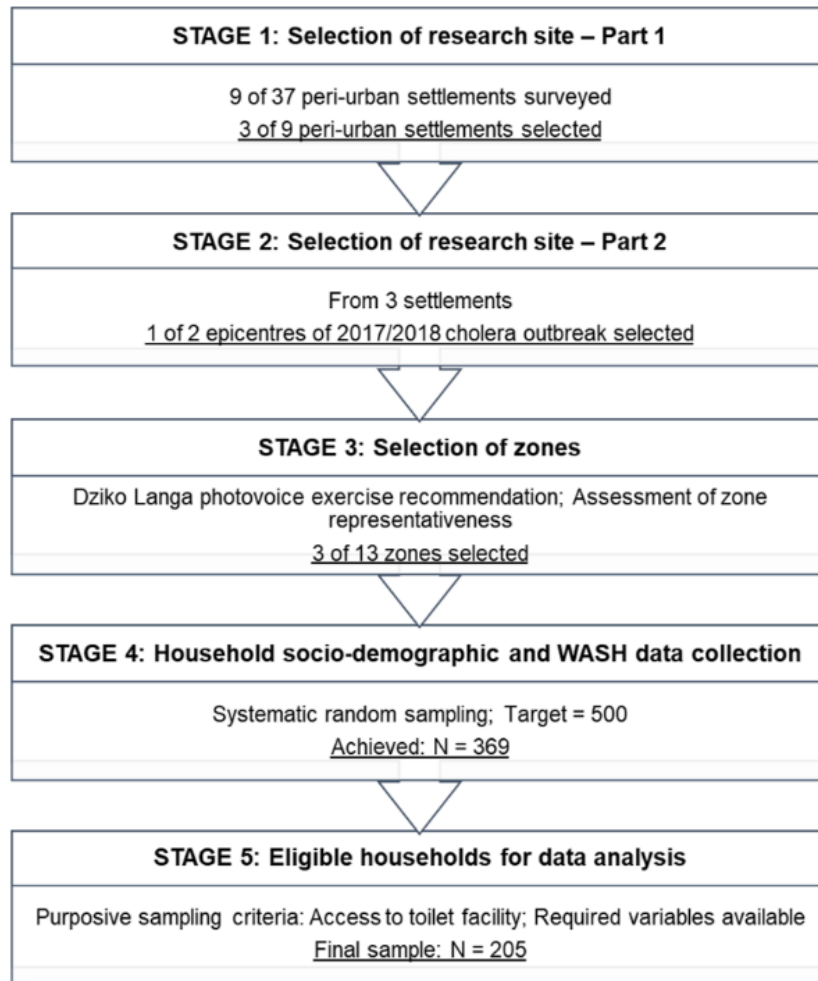


Fig 4. Flow diagram of sampling procedure (Nyambe et. al., 2018).

3.1.1 Research site

A previous WASH assessment informed the selection of the research site (i.e., Stage 1 in Fig 4) (Nyambe, Hayashi, Zulu and Yamauchi, 2018). The site was also 1 of 2 informal settlements cited as epicenters of the 2017/2018 cholera outbreak in Lusaka (i.e., Stage 2 in Fig 4) (Kappa, Sinyange, Mazaba, Musonda, Hamoonga, Kapina et al, 2018). Within the settlement, 3 out of 13 health zones were selected for data collection (i.e., Stage 3 in Fig 4). Several factors were

considered for zone selection. Dziko Langa club members' zone recommendations were requested based on their findings from a photovoice exercise focused on assessing local WASH priorities (See Chapter 2). The selected zones would also be sites for Dziko Langa's future WASH intervention through action research.

Other than recommendations from group members, criteria for zone selection considered availability of WASH facilities, public services and distance from the main road. One of the zones housed the local hospital and several government schools, another housed the biggest market in the settlement, having the 2nd largest number of households among the 13 zones, and the final zone was further in the settlement, off the main road. This variation in development, facilities and population densities among the zones ensured higher possibility of representativeness.

3.1.2 Sampling and sample size

The number of households in the settlement was 33,185 (Nyambe, Hayashi, Zulu & Yamauchi, 2018); the selected zones housed 9,114 households (representing 27.5% of the settlement). Households were selected via systematic random sampling with data collectors targeting every 5th house and marking each house after data collection to prevent duplication. Sampling commenced from an agreed intersection of the main road/boundary of each zone going into the interior, and zonal boundary markers were clearly defined to all data collectors. In cases where tenants lived in a cluster of houses with their landlords (a common occurrence in Lusaka peri-

urban) (Tidwell et.al, 2019), or where neighbors shared WASH facilities, the 5th household, regardless of who owned the WASH facilities, was the first priority for sampling and the cluster sharing WASH facilities was considered as one household. This was done to avoid duplicating facilities. In several cluster cases, approached households referred data collectors to the landlord, or neighbor in charge of the facility stating the need for permission in order to assess facilities. The sampling goal was N=500 for the overall WASH study; a sample size of N=369 was achieved (i.e., Stage 4 in Fig 4). Purposive sampling was applied on collected data; sampling criteria required households with toilets and information on all required variables (N = 205) (i.e., Stage 5 in Fig 4). Zambia's Fifth National Development Plan indicated that 10% of the peri-urban population had access to 'satisfactory' sanitation facilities (Republic of Zambia, 2006). More recent statistics however, indicated that 99% of urban households had access to a facility (regardless of whether it was improved or unimproved as per current study focus) (Central Statistical Office, 2016). Using a confidence level of 95% with our sample (N=205), the latter proportion (99%) gave a confidence interval of ± 1.36 while the former (10%) gave a confidence interval of ± 4.09 .

Sociodemographic data were requested from household heads as they were deemed responsible for and/or knowledgeable on household WASH decision making. The study followed the definition of household head as per the Zambia Living Conditions Monitoring Survey which categorized the household head as the person who normally made daily decisions concerning

the running of the household irrespective of gender and/or marital status (CSO Zambia, 2016).

Where unavailable, data collectors either collected data from the eldest/responsible available adult if permitted (≥ 18 years), returned to the household at an alternative time to collect data from the household head directly, or skipped to the next house in the sequence. This was done to ensure that the diversity of household heads in the research area (employed and unemployed) were sampled. In most cases, individuals were not willing to give information without the consent of the household head, as it was the household heads sociodemographic information that was required. In some cases, individuals contacted the household head for permission or to clarify information. The percentage of household head vs. non-household heads who divulged data was 68% vs. 32%.

3.1.3 Data collection

A questionnaire was used to collect sociodemographic data and household WASH information; questions on socio-demographic data, household sanitation, chamber use and diarrhea prevalence were extracted for the purpose of the study. Sociodemographic data was collected in alignment with criteria from the Zambia Demographic and Health Survey 2013-2014 (Central Statistical Office, 2014). Since Zambia is a signatory of the SDGs, household WASH was assessed using the 2017 World Health Organization and United Nations Children Education Fund Joint Monitoring Programs' Guidelines for WASH (hereinafter referred to as the WHO-UNICEF JMP) (World Health Organization, 2017).

Both sociodemographic and WASH data were collected using Open Data Kit (ODK) Collect as the phone application for initial data collection and Kobo Toolbox as the online data server post-collection. Data collectors had 4 days training on how to use ODK Collect, and fill in the questionnaire and checklist. Note that data collectors entered participant responses in the application, which they later verified for error before upload to the online server. To reduce error, the researcher and research assistants shadowed different pairs of data collectors through the first half of the data collection period.

3.1.3.1 Household demographic and WASH questionnaire

Sociodemographic data collected from the household head were age, gender, marital status, education level, employment status, income, house ownership and number of household members. For a more in-depth look into peri-urban sanitation, questions were also asked on toilet ownership and management (cleaning and cleaning frequency, maintenance, hygiene). This would help determine internal and external matters of access, control and management of household sanitation.

Data were also collected on the use of chambers and diarrhea prevalence. Use of chambers is a relatively well known practice in the peri-urban irrespective of an individual's access to sanitation (Nyambe, Zulu, and Yamauchi, 2018). According to an update of the WHO-UNICEF JMP, chambers fall in the category of unimproved sanitation as they present significant health risks. When disposed in the open or with solid waste, they equate to open defecation (UNICEF

and WHO, 2018). With their normalcy, an analysis of chamber use could show chamber impacts and expose barriers to toilet use in the peri-urban. Lastly, household diarrhea prevalence was assessed as per previous studies: any household member having 3 or more watery stools within 24 hours in the last 2 weeks (Tidwell et. al, 2019; CSO Zambia, 2014; Pickering, Djebbari, Lopez, Coulibaly and Aluza, 2015). This information was also collected to gauge the relationship between peri-urban health (diarrhea prevalence) and sanitation.

3.1.3.2 Household WASH checklist

WASH data were collected by viewing the households' water source, sanitation facility, fecal disposal site (e.g., septic tank) and handwashing station/location; where permitted, photographs of WASH facilities were also taken to assist later validation. GPS coordinates of all participating households were also taken for this purpose. Observations facilitated household WASH assessment via 2017 WHO-UNICEF JMP categorizations (WHO and UNICEF, 2017). In cases where households had more than one toilet or type of sanitation, the most used by the household was the one assessed.

3.1.4 Data analysis

Data were analyzed using JMP® Pro, Version 13.1.0 (SAS Institute Inc., Cary, NC, 2016) for Microsoft Windows 10 Pro. Descriptive statistics were used to analyze socio-demographic and household WASH characteristics. The association between household heads socio-demographic details and household WASH characteristics was evaluated using multivariate

stepwise logistic regression in order to identify a parsimonious set of predictors of toilet facility category, chamber use and diarrhea prevalence.

To select variables for stepwise regression, bivariate odds ratios were computed between each dependent and independent variable; only those resulting in $p < 0.25$ were included in the multivariate model. For toilet facility, eligible dependent factors were employment, income, toilet ownership, private vs. shared facility, number of households using the toilet, toilet cleaning frequency, drinking water, handwashing, chamber use and diarrhea prevalence. For chamber use, eligible dependent factors were gender, number of household members, toilet ownership, number of households using the toilet, toilet cleaning responsibility, toilet hygiene, toilet facility and diarrhea prevalence. Lastly, for diarrhea prevalence, eligible dependent variables were gender, education, private vs. shared facility, number of households using the toilet, number of persons using the toilet, toilet cleaning responsibility, toilet cleaning frequency, toilet hygiene, toilet facility and chamber use.

As per the Akaike Information Criterion, eligible factors were then computed via a backwards stepwise method to determine factors that significantly contributed to sanitation facility (Improved vs. Unimproved), chamber use (Yes vs. No) and diarrhea prevalence (Yes vs. No).

The p-value threshold for entry and removal into the model to determine Adjusted Odds Ratio (hereafter referred to as AOR) was 0.25 and 0.1 respectively. The level of significance was set at $p < 0.05$ with a confidence interval of 95%.

3.2 Results

3.2.1 Sociodemographic characteristics

Participant sociodemographic characteristics are shown in Table 3. Whilst participant percentages were almost evenly divided by age group, education level, employment status and those owning or renting their residence, the majority were female (83.4%), married/living together (70.7%), receiving irregular income (74.6%) and housing a maximum of 5 persons in their households (62.4%). Based on the varying means and sources of income, several respondents were not able to state a specific or average amount of money they earned per month, so respondents were instead categorized as having regular (known average amount) and irregular (unknown average amount) income. Categorization of regular income was irrespective of amount, and focused on respondents who could state a known consistent income pattern.

Table 3: Socio-demographic characteristics of the household head (N = 205)

Characteristic	N (%)
Age	
18-29yo	54 (26.3)
30's	58 (28.3)
40's	48 (23.4)
≥50	45 (22.0)
Gender	
Male	34 (16.6)
Female	171 (83.4)
Marital Status	
Married/Living together	145 (70.7)
Single	60 (29.3)
Education	
Secondary/above	100 (48.8)

Primary/below	105 (51.2)
Employment	
Employed	86 (42.0)
Unemployed	119 (58.0)
Income	
Regular	52 (25.4)
Irregular	153 (74.6)
House Ownership	
Resident/Family	91 (44.4)
Rental	114 (55.6)
Household Members	
≤5 persons	128 (62.4)
≥6 persons	77 (37.6)

3.2.2 Household WASH and diarrhea characteristics

Table 4 outlines information on the households' WASH status, sanitation characteristics and diarrhea prevalence. The distribution of characteristics among persons using the toilet, toilet cleaning and hygiene responsibility, and handwashing facility status was relatively even. Majority of toilets were not owned by the household (resident), but externally (74.1%) which was also reflected in 80.5% of toilets being shared. The majority of shared toilets were used by ≤5 households (73.2%); the maximum number of households registered as using one toilet was 20 (Median = 3), and the maximum number of persons using one toilet was 33 (Median = 9.5). To incorporate the aspect of toilet sharing into number of toilet users, we considered the sharing of 1 toilet by 2 average households (N = 9.4 persons). As such, toilet users were divided into ≤9 persons (49.3%) vs. ≥10 persons (50.7%).

With multiple users and owners of sanitation facilities, the responsibilities of toilet cleaning,

maintenance (in case of toilet damage, or emptying) and hygiene (the supply of hygiene materials such as toilet paper, cleaning materials and handwashing station for example) were divided into resident and external (Tidwell et. al, 2019). Resident management of toilet cleaning and hygiene was at 49.8% and 53.7% respectively. Most participants reported that toilet cleaning was done several times a day to daily (92.7%). The majority of toilets (89.8%) underwent a form of maintenance when damaged, malfunctioning or full (including emptying for pit latrines); of the sample, 29.6% of participants attested to use of a chamber. Access to improved toilet facility was at 72.7%, and drinking water at 84.9%. Having a handwashing facility was at 41.0%. Household diarrhea prevalence within the past 2 weeks was at 8.3%.

Table 4: Household WASH and diarrhea characteristics

Characteristic	N (%)
Toilet ownership	
Resident	53 (25.9)
External (Landlord/Other)	152 (74.1)
Private vs. Shared toilet	
Private	40 (19.5)
Shared	165 (80.5)
Households using toilet	
≤5 households	150 (73.2)
≥6 households	55 (26.8)
Persons using toilet	
≤9 persons	100 (48.8)
≥10 persons	105 (51.2)
Responsible: Toilet cleaning	
Resident	102 (49.8)
External (Landlord/Other)	103 (50.2)
Toilet cleaning frequency	

Characteristic	N (%)
Several times a day to Daily	190 (92.7)
Several times a week to Never	15 (7.3)
Toilet maintenance (+Emptying)	
Yes	184 (89.8)
No	21 (10.2)
Responsible: Toilet Hygiene	
Resident	110 (53.7)
External (Landlord/Other)	95 (46.3)
Toilet facility	
Improved	149 (72.7)
Unimproved	56 (27.3)
Drinking water	
Improved	174 (84.9)
Unimproved	31 (15.1)
Handwashing	
Facility	84 (41.0)
No Facility	121 (59.0)
Chamber use	
Yes	61 (29.8)
No	144 (70.2)
Diarrhea prevalence	
Yes	17 (8.3)
No	188 (91.7)

3.2.3 Factors contributing to improved toilet facility access

Table 5 gives results for logistic regression analysis of factors associated with households having access to an improved toilet facility. The significant independent predictors that increased odds for improved toilet facility access and use were regular household income (AOR = 6.29, 95% confidence interval [CI]: 1.71-23.14), having a private toilet (AOR = 4.43, 95% CI: 1.42-13.87), having access to a handwashing facility (AOR = 7.98, 95% CI: 2.90-21.95), improved drinking water (AOR = 4.80, 95% CI: 1.68-13.77), and households with diarrhea

prevalence (AOR = 10.89, 95% CI: 1.54-77.10). The odds of having access to an improved toilet facility were less for persons who used chambers (AOR = 0.27, 95% CI: 0.12-0.64).

Table 5: Logistic regression analysis - improved toilet facility access

Variable	Improved facility, N (%)	AOR (95% CI)
Income		
Regular	49 (94.23)	6.29 (1.71-23.14)**
Irregular	100 (65.36)	1
Private vs. Shared toilet		
Private	34 (85.00)	4.43 (1.42-13.87)*
Shared	115 (69.70)	1
Handwashing		
Facility	78 (92.86)	7.98 (2.90-21.95)**
No Facility	71 (58.68)	1
Drinking water		
Improved	139 (79.89)	4.80 (1.68-13.77)**
Unimproved	10 (32.26)	1
Chamber use		
Yes	36 (59.02)	0.27 (0.12-0.64)**
No	113 (78.47)	1
Diarrhea prevalence		
Yes	15 (88.24)	10.89 (1.54-77.10)*
No	134 (71.28)	1

*P < .05; **P < .01

3.2.4 Factors contributing to chamber use

Table 6 shows the logistic regression analysis of factors associated with using a chamber. Independent predictors of using a chamber were being female (AOR = 3.41, 95% CI: 1.10-10.53), residents ownership of the toilet (AOR = 4.14, 95% CI: 1.81-9.48), and toilet hygiene being handled externally (AOR = 3.36, 95% CI: 1.56-7.25). Additionally, chamber users had

higher odds of having diarrhea (AOR = 6.49, 95% CI: 1.99-21.11) and were more likely to have an unimproved toilet facility (AOR = 2.33, 95% CI: 1.12-4.87).

Table 6: Logistic regression analysis of factors associated with chamber use

Characteristics	Using a chamber, N (%)	AOR (95% CI)
Gender		
Male	6 (17.65)	1
Female	55 (32.16)	3.41 (1.10-10.53)*
Toilet ownership		
External (Landlord/Other)	25 (47.17)	1
Resident	36 (23.68)	4.14 (1.81-9.48)**
Responsible: Toilet hygiene		
Resident	24 (21.82)	1
External (Landlord/Other)	37 (38.95)	3.36 (1.56-7.25)**
Diarrhea prevalence		
No	50 (26.60)	1
Yes	11 (64.71)	6.49 (1.99-21.11)**
Toilet facility		
Improved	36 (24.16)	1
Unimproved	25 (44.64)	2.33 (1.12-4.87)*

*P < .05; **P < .01

Table 6 indicated that the odds of chamber use were higher for households with access to unimproved toilets. Additional data analysis further revealed that unimproved toilets were more likely owned by residents than external toilet owners like landlords (OR = 2.46, 95% CI: 1.26-4.80; p < .01). Moreover, resident/family house ownership also increased the odds of having access to private facilities (OR = 4.38, 95% CI: 2.04-9.39; p < .01).

3.2.5 Factors contributing to household diarrhea prevalence

Table 7 shows the logistic regression analysis of factors associated with household member

diarrhea prevalence in the past 2 weeks. Number of households using a toilet and whether a toilet was private or shared did not offer any significant result to diarrhea prevalence. Higher odds were found however, for having a toilet used by ≥ 10 people and having diarrhea (AOR = 3.80, 95% CI: 1.11-13.08). The odds for having diarrhea were found to be lower for persons not using a chamber (AOR = 0.16, 95% CI: 0.05-0.48) and using an unimproved toilet facility (AOR = 0.18, 95% CI: 0.04-0.90). Access to improved drinking water and having a handwashing facility gave no significant results.

Table 7: Logistic regression analysis - household diarrhea prevalence

Characteristics	Having diarrhea, N (%)	AOR (95% CI)
Persons using toilet		
≤ 9 persons	4 (4.00)	1
≥ 10 persons	13 (12.38)	3.80 (1.11-13.08)*
Chamber use		
Yes	11 (18.03)	1
No	6 (4.17)	0.16 (0.05-0.48)**
Toilet facility		
Improved	15 (10.07)	1
Unimproved	2 (3.57)	0.18 (0.04-0.90)*

*P < .05; **P < .01

CHAPTER IV

BARRIERS AND ENABLERS TO COMMUNITY INTERVENTION IN PERI-URBAN WASH&W MANAGEMENT

4.1 Methodology

The main objective of this research was to identify barriers and enablers to community intervention in the peri-urban WASH&W sector. The study made use of DL youth photovoice findings and recommendations made in Chapter II. Based on their findings, DL members conducted and/or took part in several interventions in their peri-urban communities. An executive meeting with DL youth registered 22 interventions and trainings conducted from August 2017 to October 2019. Bi-weekly meetings and/or occasional in-house trainings were excluded. The study focused on interventions conducted in 2018 (n=11) which were conducted by and/or in collaboration with DL child and youth members. The study then used thematic analysis and set calibration to identify barriers and enablers to community intervention in the peri-urban WASH&W sector.

The key actors in this chapter are: (i) DL members who were leaders, participants and collaborators in the analyzed interventions; (ii) peri-urban residents and/or the general public hereinafter referred to as ‘the target audience’; (iii) the research team; and lastly (iv) external collaborators (skilled professionals, government bodies/officials, other). Note that the researcher team was involved throughout the research process, and their contribution was only

mentioned when it was integral.

4.1.1 DL interventions

Table 8 gives an outline of the 11 interventions in chronological order. It indicates the intervention site, duration and aim. For interventions initiated by DL, information was outlined based on participant decisions (i.e., intervention aims) and actual pre-, during and post event occurrences and closeout meeting discussions. For those by external bodies, all information was recorded based on actual occurrences. Bonus interventions (coded as ‘B’) were those in which DL was invited, whilst DL-led interventions (coded as ‘C’) were either initiated by DL and/or content, programing and planning was designed by DL.

Table 8: Summary of DL interventions 2018

Code	Intervention (+Duration, Site)	Aim
C1	Community Clean-ups (1 day, Site A)	-Clean-up of health center; Publicity for DL
C2	Sanitation Exhibition (1 day/site: Site A & B)	-Community WASH edu.; Problem sharing with residents, civic leaders; Publicity for DL
C3	Zambia Water Forum & Exhibition (ZAWAFE) (3 days, Conference hall)	-Networking; Publicity for DL; Community WASH&W management edu; Problem sharing with community
B1	Recyclable Plastic Waste Collection (1 day, Site C)	-Waste management edu.; Waste collection; Networking
C4	DL Registration (5 months, Site A & B)	-Formal recognition of DL; Extended work reach -Sustainability measures (e.g., creation of funds)
C5	Social Enterprise Business Start-up (July 2018 to date, Site A, B, Other)	-Sustainability measures: DL finance (business, Hult Prize Comp.); Youth employment (personal income) -Waste collection, sorting, recycling (plastic for bricks)

Code	Intervention (+Duration, Site)	Aim
C6	Sanitation Festival Day 1: March Past (Day 1 of 3 day event, Town center - Site B)	-Community WASH&W management edu.; Problem sharing with community, civic leaders; DL Publicity -Clean-up: Waste collection, sweeping of markets; Public action (engaging citizens in clean-up)
C7	Sanitation Festival Day 2: Waste Collection (Day 2 of 3, Site B)	-Community WASH&W management edu.; Problem sharing with community; DL Publicity; Waste collection; Public action (engagement in clean-up)
C8	Sanitation Festival Day 3: WASH Education (Day 1 of 3, Site A)	-Community WASH&W management edu.; Problem sharing with community; Publicity for DL -Education on available WASH bodies
B2	World Clean-up Day (1 day, Town Center)	-Waste collection -Networking
B3	Waste Workshop (3 days, private venue)	-Waste management edu.; Waste collection -Networking

Code B: Bonus interventions (DL was invited); Code C: DL-led interventions

As DL member research was the basis of intervention choice and focus, interventions primarily used a bottom-up approach. The following aspects however, must be taken note of: (i) the Sanitation Exhibition and Festival were recommended by the researcher as part of the study plan, but content of the interventions was decided by DL members; (ii) whilst the studies primary focus was on WASH, findings and interests of DL members incorporated and placed waste management at a more central position, an important aspect of the action research process; and (iii) compared to other interventions, the business start-up had greater collaboration between DL members and researchers, with researchers representing DL members in the 2019 Hult Prize Competition themed “For Us By Us, Youth Unemployment: Can you build the foundations of a venture that will provide meaningful work for 10,000 youth within the next decade?”

4.1.2 Research sites

As per table 9, four (4) of the 11 interventions were done beyond the boundaries of the two (2) primary research sites: Site A & B (N = 7), other parts of Lusaka (N = 4). All interventions were conducted within the parameters of Lusaka City and with focus on the peri-urban. All DL initiated/planned interventions were conducted predominantly in or with focus on Site A & B. Other intervention locations were Lusaka Town Centre (C3, C6, B2), a peri-urban settlement (B1), a workshop (B3) and a conference venue (C3). The Hult Prize Competitions held in Japan and Vietnam count for 'Other' in intervention C5. Figure 5 shows the intervention locations by intervention code, whilst the main intervention activities are listed in Table 9. The target audience, collaborators and intervention requirements are lastly, outlined in Table 10.

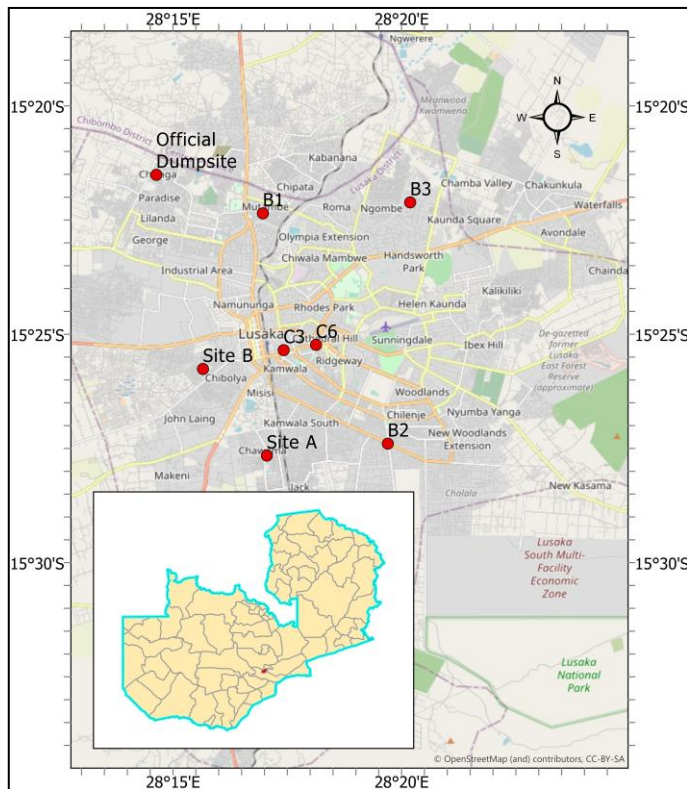


Fig 5: Intervention sites in Lusaka, Zambia by code

Table 9: Summary of DL intervention activities

No.	Code	Activity
1	C1, B1, C5, C6, C7, B2	Clean-ups (waste collection/disposal, sweeping)
2	C2, C3, B1, C5, C6, C7, C8, B3	WASH&W edu. (Photovoice and/or art, exhibition booth, oral presentation, flyers, pilot)
3	C2, C3, C6, C7, C8, B2	Official opening (Civic leader/Guest of Honor, i.e., GoH)
4	C2, C3, C5, C6, C7, C8	Networking, media engagement
5	C4, C5	Meetings, formal documentation preparations
6	C5, B1	Competitions (Hult Prize, waste collection)

Table 10: DL intervention details

Code	Target	Collaborators	Required
C1	Health Centre	-Site A Mentor; Ward Dev. Committee; Civic leader	-Formal letters -Cleaning tools; Protective clothing
C2	-Residents -Civic leaders -Media	-Site A & B Mentors -Site A School -Site B civic leader	-Venue; Tent, high table, PA system; Gift, speeches (GoH); Photographs (youth); artwork (children); Letters; Police & health center clearance; Fliers
C3	-General public -Civic leaders -WASH stakehold.	-Researcher	-Abstracts, oral presentations; Fee/waiver request; Exhibition booth setup (as per C2 exhibit)
B1	-Collection area	-Event organizer; Inviting NGO	-Transport money
C4	-Govt; Residents -Funders; Collaborators	-Site A Mentor; Researcher	-DL Profile; DL Constitution; 10 Board Members (IDs, Police clearance); Registration Fee
C5	-Peri-urban youth & settlements -Waste disposers & recyclers	-Site B civic leader; Lusaka City Council (LCC); Site A Mentor; Researcher	-Legal permissions; Waste management equipment -Partnerships; Business plans, presentations; Pilot: venue, waste collection, sorting

Code	Target	Collaborators	Required
C6	-Residents -Civic leaders -Media -Marketers	-Site A & B Mentors; Site B govt. office; LCC; Private water comp.; Recycling comp.; Schools, churches (children, youth)	-Venue; Tent, high table, PA system; Gift & speeches (GoH, hosts); Clean-up tools; Fliers; Formal letters; Police & LCC clearance; Food & transport; Service fees (marching band, traffic police, etc.)
C7	-Residents -Civic leaders -Media	-LCC; Recycling company; Private water company; Venue chair; Health ambassadors; Schools & churches (children, youth)	-Venue; Tent, high table, PA system; Gift & speeches (GoH, hosts); Clean-up tools; Fliers; Formal letters; Police & LCC clearance; Food & transport; Service fees (health ambas.)
C8	-Residents -Media	-Recycling company (information sharing) -School (community ground, electricity)	-Venue; Tent, high table, PA system; Gift & speeches (GoH, hosts); Clean-up tools; Fliers; Formal letters; Police clearance
B2	-Collection area -WASH stakehold.	-Inviting NGO)	-Transport money
B3	-DL participants	-Inviting NGO; Organizing NGO	-Application submission; Transportation

4.1.3 Data analysis

To identify the patterns and themes within the interventions, the researcher again drew on Maguire & Delahunt's (2017) practical guide on thematic analysis (as per Chapter II). To make a more succinct analysis, the researcher moderately drew on Set Calibration (Basurto & Speer, 2012; Mello, 2020) in order to create themes that encompass both enablers to barriers across a spectrum. The framing question was, 'What are the enablers and barriers to community participation in peri-urban WASH&W management intervention?' The results were then placed into ecological theory. Note that interventions were not graded into successful or unsuccessful.

4.2. Results

Results highlight various enablers and barriers existing pre-, during and post intervention, placing them into their specific theme and sub-theme. In total, 6 themes were identified with a collective total of 24 sub-themes. They are broken down into affective enablers and barriers per intervention and a collective score sums up the weight of each theme across the interventions. As these themes and sub-themes affect multiple parts of the ecological model, these are also broken down per theme and sub-theme for clarity of results. A recommended model for community engagement in WASH&W intervention running two-way between policy and intrapersonal levels is then revealed.

4.2.1 Enablers and barriers to community intervention by theme and sub-theme

Table 11 gives a summary linking enablers and barriers to sub-themes and overall themes. The number of sub-themes (ST) under each theme are indicated in brackets alongside the theme.

Table 11: Thematic breakdown of enablers and barriers to WASH&W intervention

Theme	Sub-theme (ST)	Enablers & Barriers
Tools (ST = 5)	Work equipment	Available & sufficient tools; Tested methods & templates; Competitions & platforms, e.g., Hult Prize
	Work site	Intervention site, e.g., exhibition venue; Service site, e.g., official dumpsite; On/offline communication platforms (Meeting venue, technology)
	Knowledge	Trainings, e.g., waste separation, academic presentations; Open discussions; Ideation
	Finance	Setup, required materials, skilled service, registration, transportation, food, service fees, protocols, etc.

Theme	Sub-theme (ST)	Enablers & Barriers
	Education	Content; Teaching tools
Relevance (ST = 4)	Need	Practical intervention necessary; Relevant topic; applicable to target; Participation from target
	Interest	Young experts; Local representation; Media coverage
	Motivation	Opportunities; Feeling of ownership; youth unemployment
	Policy support	National ‘Keep Zambia Clean Campaign’; Community clubs
Feasibility (ST = 4)	Skillset	DL skillset (literacy, lobbying, event planning), experience (past work); DL data analysis prior to intervention
	Scale	Workload; Goals; Last minute cancellation/changes; Duration
	Planning	Intervention method; Early scheduling; Convenience (children, employed youth, access)
	Limitations	Member attendance due to personal activities (school, work, other); Event timing (school, work, transport access)
Collaboration (ST = 4)	Responsibility sharing	Research team; Participant & collaborator skills; Mentorship, support; Influential persons/leaders; Deliverables; No shows; Professionalism, e.g., time management, work culture
	Grants	Fee waivers; free water; free venue; free training
	Reputation	Working history; Past success (e.g., Hult Prize win)
	Means of engagement	Participation costs (DL, other); invitation; networking (links, connections, interventions); inclusivity; follow-ups
Bureaucracies (ST = 3)	Formalities	Formal documentation (introduction letter); Permissions; Requirements: simplified, adequate members
	Protocols	Event procedure; Red tape
	Centralization	Multiple bureaucracies; Monopolies; Difficult information access; Hierarchy; Legal restrictions
Access to target	Venue	Open, enclosed, free venue: public march, exhibition, festival, workshop venues; transportation
	Handouts	Requests for handouts; participant incentives (soap, water)

Theme	Sub-theme (ST)	Enablers & Barriers
	Communication	Pre-event advertisement; Online platforms; Accessible civic leaders; Information flow
	Inclusivity	Community participation (schools, churches, public); Trust; Participant limit

4.2.2: Summary of enablers and barriers by themes and sub-themes per case

To clarify the results, themes were totaled into percentages based on the number of sub-themes presented in each intervention as an enabler or barrier. Interventions were thus, broken down by how much a specific enabler or barrier represented them. The maximum score for each intervention totaled 100% being calculated as how many sub-themes were represented under each theme, e.g., 3/5 enabling sub-themes under Tools will equal an enabling score of 60% for Tools. The collective impact of a theme across all interventions was represented under ‘ALL’.

Figures 6 shows the breakdown for enablers, and figure 7 for barriers.

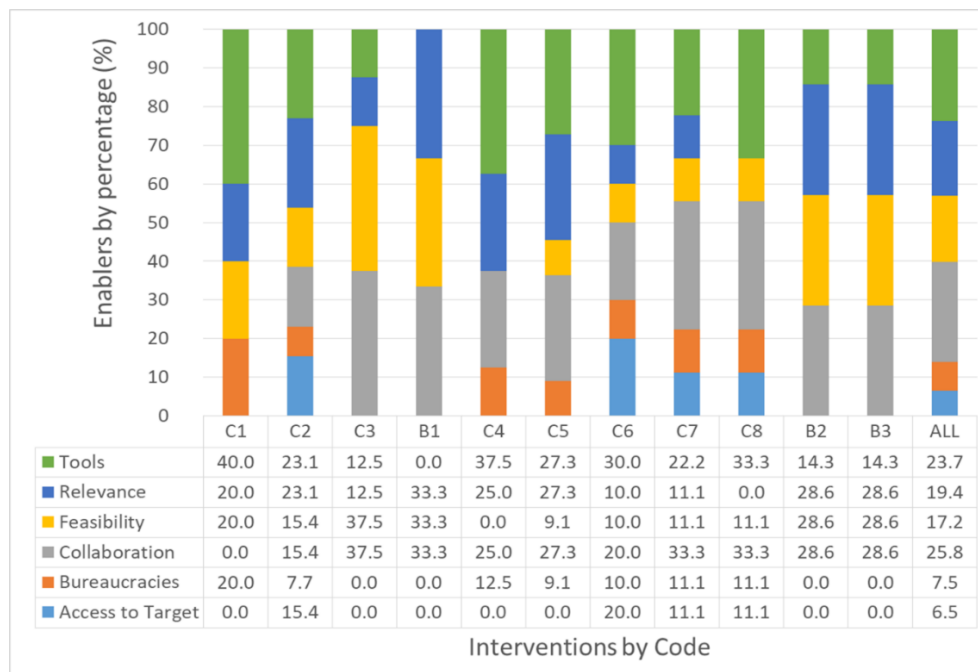


Fig 6: Summary of enablers by themes and sub-themes per intervention

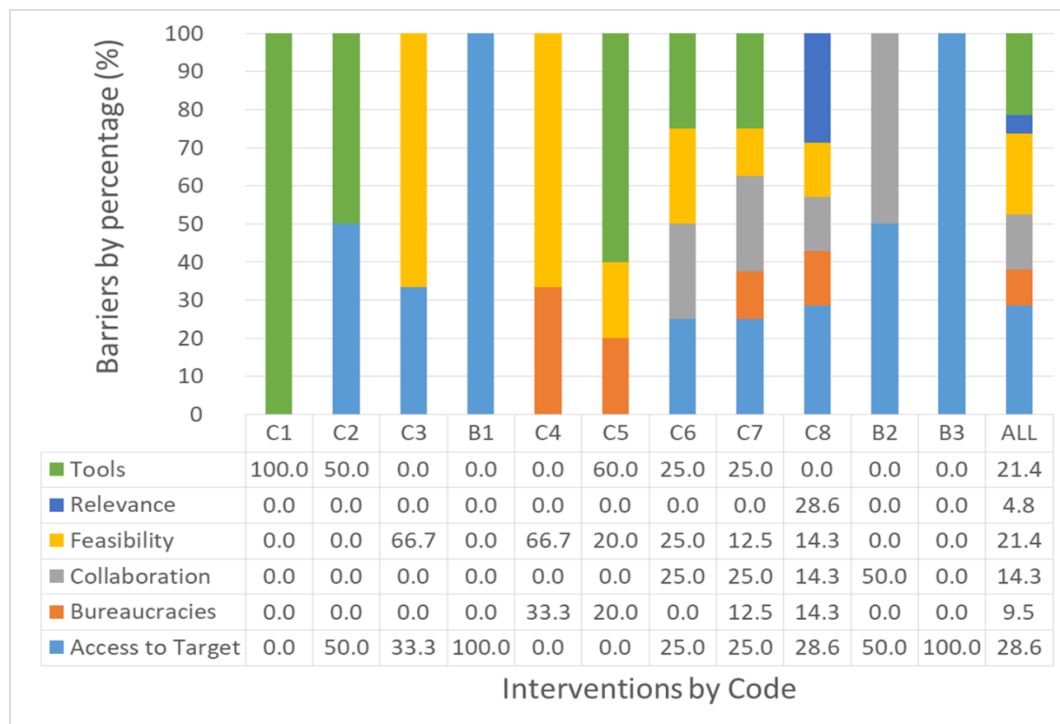


Fig 7: Summary of barriers by themes and sub-themes per intervention

Overall, Collaboration had the highest score amongst enablers (25.8%) followed by Tools (23.7%) and Relevance (19.4%). Access to target had the least enabling score (6.5%), followed by Bureaucracies (7.5%) and Feasibility (17.2%). For barriers, Access to target was highest (28.6%), followed by Feasibility (21.4%) and Tools (21.4%). The lowest barrier score was registered under Relevance (4.8%), followed by Bureaucracies (9.5%) and finally Collaboration (14.3%).

4.2.3: Thematic analysis identifying enablers and barriers by Ecological Theory

In Figure 8, the themes and sub-themes were finally, consolidated into ecological theory. At each level, the key actors were indicated. Based on enablers and barriers, a Community-based

Organization (CBO) box was developed to indicate and recommend best practice for organizations like DL. It also highlights the unique role these organizations can and should play in improving and engaging peri-urban settlements.

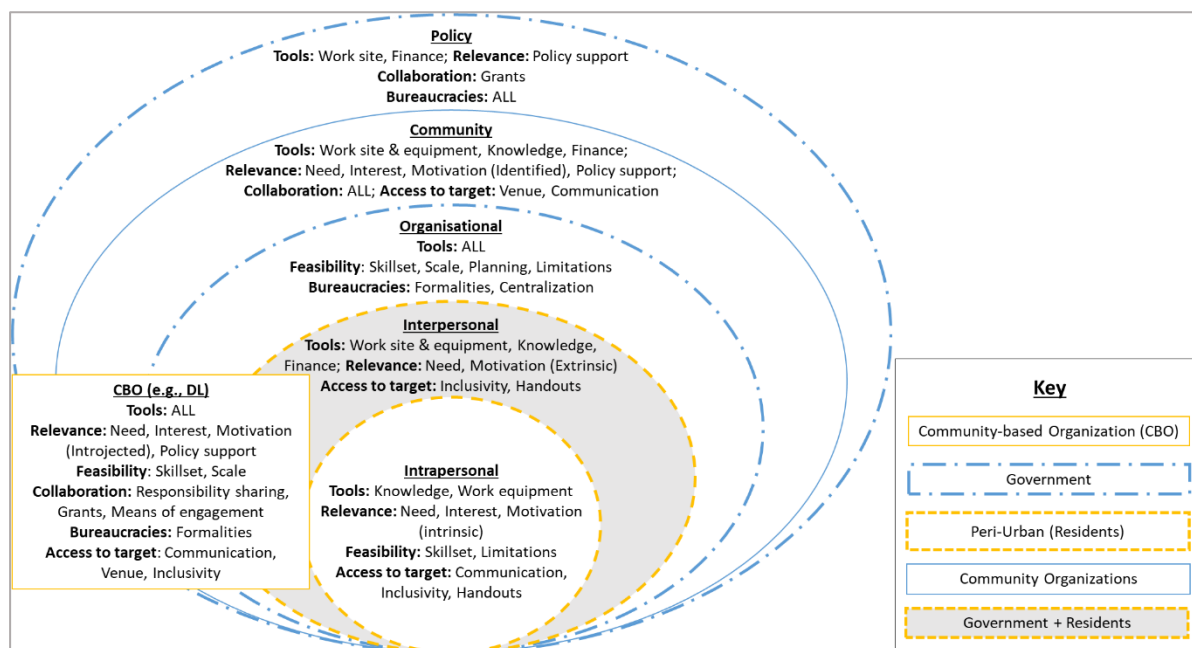


Fig 8: Thematic analysis identifying enablers and barriers by Ecological Theory

CHAPTER V

DISCUSSION

This chapter discusses the 3 previous chapters, giving their recommendations and summary.

5.1 Defining peri-urban WASH

5.1.1 WASH is Poor Practice, Substandard and Unregulated, Health Hazard

The description of peri-urban WASH as Poor Practice (PP) indicates PP as emanating from

Substandard and Unregulated (SU) WASH within the peri-urban, and individual habits of residents regardless of the latter (see figure 2). SU and PP are basal descriptions: the definition of the peri-urban/slums (i.e., substandard, unplanned settlements = Public Policy, SU) (CSO Zambia, 2016), and human predisposition brought into the environment (i.e., attitudes, practices, habits, personal choice = Intrapersonal, PP). As such, it should be noted that SU WASH was the start point on which these settlements began rather than a state to which they deteriorated to.

The status quo of WASH in the peri-urban could rightly therefore, be linked to a lack of required WASH facilities leading to PP as stated by participants. On the other hand, it could also be a habitual way of life that existed from the onset and has been perpetuated over time. In a study comparing habit and choice in health related decision making, it was found that people in lower social positions (economic status) were more inclined to rely on their habits and accordingly less likely to change their behavior. A key reason for this phenomenon was the expended energy and stress involved in the decision making process for what often turned out an unattainable result (Lindbladh and Lyttkens, 2002). That is, not only was choice limited, but striving for change was often disappointing.

That said, forums for community participation in local government development activities were lacking (Munshifwa and Mooya, 2016). Figure 2 highlights a lack of meaningful engagement between public policy, community and organizational levels in the peri-urban WASH system

with participants mentioning a lack of policy to support greater engagement of residents in WASH, poor standards and implementation thereof, known and unchecked malpractice from service providers and limited means for regulation and accountability (Laverack, 2018; Munshifwa and Mooya, 2016). Whilst there were ways in which residents accessed WASH information (e.g., through local health centers) a predominantly top-down approach was utilized in which the majority of residents were recipients rather than contributors to the peri-urban WASH system beyond intra/interpersonal levels.

This system failure encompassing SU and PP led to the final theme, Health Hazard (HH). The yearly outbreak of waterborne disease emanating from peri-urban areas is a testament to the participants' definition of WASH, with several of these outbreaks spreading to other parts of the city and the country (Sinyange, Brunkard, Kapata, Mazaba, Musonda, Hamoonga et al, 2018; Sasaki, Suzuki, Igarashi, Tambatamba, and Mulenga, 2008). That being said, all participant information relating to the theme HH could be linked to both PP and SU deeming the WASH status quo as a sustained community norm.

5.1.2 Hope for Change (HC)

Participant discussion revealed Hope for Change (HC) as emanating from intra- and interpersonal levels rather than through government. Whilst individual knowledge, attitudes and practices (KAPs) have been proved to have a bearing on WASH health behaviors, access to WASH hardware is an unavoidable factor (Peal, Evans, & Voorden, 2010; Satterthwaite et.

al, 2015).

As of 1974 however, the Zambian government moved to change the status of several peri-urban settlements from illegal-unplanned to improvement areas, granting them legal status, government provision of social and physical infrastructure and title deeds for residents (Munshifwa and Mooya, 2016). This upgrade was therefore, the official start of government intervention into peri-urban development, warranting government installation of peri-urban WASH systems, infrastructure, regulation and implementation of regulations and standards.

With the aim of assisting licensed commercial utilities towards improvement and extension of water supply and sanitation in the peri-urban and low cost areas of the country, the Devolution Trust Fund was established in 2001. Through a basket fund from 2003-2018, a total of 1,179,506 peri-urban residents nationwide were covered (National Water Supply and Sanitation Council, 2018) accounting for only ~23% of the peri-urban populace (Kinyanjui, 2010). With the limited coverage, it is not surprising that peri-urban WASH was still described as SU being subdivided into: i) a lack of local standards to differentiate good from bad and guide towards good practice; ii) a lack of regulations to ensure quality control and dissuade PP; and iii) malpractice in provision of quality peri-urban WASH by official providers.

It has been documented that several governments, just as individuals, struggle with the costs of upgrading WASH (Satterthwaite et. al, 2015). This makes it difficult for both governments and individuals to follow WASH guidelines and regulations to which quality WASH facilities and

services may not be available or easily obtainable. Consequently, this mismatch in the peri-urban also makes several planned interventions unattainable/unusable.

Though recommended in previous studies (Foster-Fishman et. al, 2010), local knowledge is barely explored and community priorities are often overlooked. This contributed to participant categorization of Hope for Change at inter-intra personal level. Even so, based on their study focused on Environmental Health Promotion using photovoice, Postma and Ramon (2016) recommended community engagement as a tool towards policy change to align local efforts and social frameworks, citing an increase in community strengthening.

5.1.3 Recommendations for Peri-urban WASH

Despite HC being viewed primarily through intra- and interpersonal levels, Table 2 recommendations and system links and interplays highlighted in figures 3 indicated an awareness from participants that improved peri-urban WASH required multiple partnerships between residents (intra/interpersonal levels) and broader government bodies and systems (public policy and organizational) (Laverack, 2017; Munshifwa and Mooya, 2016).

As per figure 3, Zambia is a signatory to the United Nations Sustainable Development Goals which impact national WASH policy development and implementation. Discussion and subsequent recommendation from participants revealed a mismatch between government and local knowledge on international and national standards, resolutions and requirements to meet those standards, resulting in suggested policy aimed towards health promotion and community

engagement (see Table 2, points 1.2 and 1.3 respectively) (Laverack 2017).

Likewise, participants' recommended WASH policy developments had a direct impact on peri-urban WASH infrastructure, law enforcement, regulation, health promotion and engagement, with 'intentional' engagement (organizational, community) being the sole multidirectional link between the peri-urban (intra/interpersonal) and government (public policy, organizational); that engaging with residents through community organizations and public-private partnerships (PPPs) was the most efficient means for holistic WASH intervention within the peri-urban due to its ability to empower, create dialogue amongst stakeholders and allow for resident input in policy and planning (Postma and Ramon, 2016).

The Zambia National Water Policy of 2010 (Ministry of Energy and Water Development, 2010) maintained the long-term adoption of the 1996 WASHE (Water, Sanitation, and Health Education) concept as a national strategy for the improvement of water supply and sanitation services across rural Zambia through engagement and decentralization of WASH. WASHE was however, not applied in the urban/peri-urban setting. More so, reports on WASHEs rural impact indicated a failure from government to implement the policy and subsequently decentralize, causing a failure in improved service delivery and pushing forth a recommendation towards recentralization (Lungu and Harvey, 2019). The power imbalance highlighted in WASH as stated by Lungu & Harvey (2019) and Postma and Ramon (2016) can be coupled with Lindbladh and Lyttkens (2016) reasoning of social economic status and choice, and the

participant breakdown of peri-urban WASH relating to HC.

The flow from health promotion to intervention is a common premise, that knowledge influences attitude and practice (Laverack, 2017); and that intervention done in tandem with local residents would produce the greatest change. Its link via engagement however, further implied the importance of local decision making, partnership and resident ownership for the purpose of innovation, implementing and defending standards, thereby enhancing residents' responsibility and participation in improving local WASH. This linked residents to government in infrastructural development and safeguarding of government WASH inputs.

Via Ecological Theory (McLeroy, Bibeau, Steckler and Glanz, 1988), the lack of peri-urban engagement at community and organizational levels was evident. Engagement as viewed by participants focused not only on government incorporation of residents in policy development, implementation and capacity building, but also failures from public and private WASH bodies at organizational level to incorporate residents in peri-urban project planning and implementation through Public-Private Partnerships (PPPs) and Community-Based Organizations (CBOs). The lack of resident incorporation often revealed a mismatch between resident and organizational WASH priorities (Laverack, 2017). Participants lobbied for more resident run WASH organizations that could work with organizational level institutions to inform public policy, ensuring peri-urban residents were empowered and engaged both on the ground and at the higher end. With this, participants also lobbied for government facilitation of

resident WASH initiatives and priorities (see table 2: 1.3 and 10.3) to ensure improved capacity building, health promotion, project monitoring and cooperation towards improved peri-urban WASH.

5.1.4 Summary

Participants defined peri-urban WASH as poor practice (intrapersonal, interpersonal), a health hazard (community norm), substandard and unregulated (public policy, organizational), and offering hope for change (intrapersonal, interpersonal). Participant findings revealed a public policy gap, with standards, regulations and implementation having minimal impact on peri-urban WASH. Participant recommendations revealed a logical flow for health promotion, highlighting community engagement and PPPs as an integral yet underwhelming link, having negative impact on residents' participation and intervention in peri-urban WASH.

Rather than a top-down approach, participants recommended a more integrated relationship between government and peri-urban residents via community engagement, offering residents more empowerment for intervention, implementation and defending of standards and regulations within the peri-urban. However, without a change in current peri-urban WASH power dynamics (top-down approaches) to cooperation and inclusion (capacity building, knowledge sharing, joint problem solving), real peri-urban empowerment and engagement may be unsuccessful. The use of participatory research tools that empower the disadvantaged could go a long way in creating means towards inclusive models and subsequently, resident,

organizational and policy approved collaborative peri-urban WASH interventions.

5.2 Factors influencing peri-urban WASH (diarrhea prevalence)

With both improved and unimproved sanitation bearing risk to household diarrhea prevalence, further analysis of peri-urban socio-demographics linked to diarrhea prevalence and sanitation characteristics were made. Interestingly, there was no significant risk between diarrhea prevalence and drinking water or handwashing. There were also no significant findings linking household diarrhea prevalence and the frequency of toilet cleaning or if toilet maintenance and emptying was conducted.

The only significant result found in addition to having an improved toilet facility and using a chamber was the number of persons using the toilet. Toilets used by ≥ 10 persons were found to increase the risk of household diarrhea prevalence (AOR = 3.80, 95% CI: 1.11-13.08). Rather than households, the focus on number of persons using the toilet allows a more direct count of users, bearing in mind household dynamics, i.e., the extended family system and communal society. It takes into account both the formal and informal nature of toilet sharing which private toilets are not removed from due to the fact that some private toilets may have more usage than shared toilets due to the number of household members and overall users. That said, number of households using a toilet and whether a toilet was private or shared did not offer any significant result to diarrhea prevalence.

Attention to and control of the number of users may help to tackle aspects of overuse, misuse and subsequent fecal contamination. With the status quo of the peri-urban however, this act may not be feasible: space for toilet construction may be lacking and the costs of management for additional toilet facilities would be considered high (Satterwaite, Mitlin and Bartlett, 2015). Nevertheless, the finding reiterates firstly, that the call to end open defecation primarily through the use of toilet facilities shifts fecal contamination points from open air locations to toilets, defeating the purpose of installation and use of these facilities (Satterwaite, Mitlin and Bartlett, 2015). Secondly, that in the promotion of toilet ownership and usage, education on how to use and maintain facilities should be considered a package deal to allow the reasons for promoting toilet use against open defecation to retain meaning (Satterwaite, Mitlin and Bartlett, 2015; Kumar and Vollmer, 2013; Keiringira, Atekyereza, Niwagaba and Gunther, 2014). An important point to be garnered from the results is the inability of sanitation facilities on their own, whether improved or unimproved, to alleviate the disease burden. Proper use and maintenance must be considered to allow safe use of facilities by multiple users.

5.2.1 Summary

Key findings of the study indicate a duality of peri-urban sanitation, with households making use of both improved and unimproved sanitation. Sociodemographic characteristics related to use of improved toilet facility and chambers were income and gender respectively. The impact of income on sanitation is a reflection of the cost implications that hinder the right to sanitation

for the urban poor; whilst the gender disparity on chamber use indicates the diverse needs of women and girls, and the subsequent social disparities often overlooked relating to the adequate provision of peri-urban sanitation.

Findings also highlighted an interlinkage between household WASH access and quality, with the ownership of an improved toilet facility predicting improved drinking water, presence of hygiene facility and lowering the odds of chamber use (unimproved sanitation methods), but like chambers, having high odds for household diarrhea prevalence. This indicates inefficiencies with the system requiring alternatives and a failure of the facility to protect users' from fecal contamination. The result prompts a shift towards education on proper toilet facility use and management to reduce health risk in high density areas, particularly with an increased number of users heightening risk. For unimproved toilet users (the more likely to use chambers), it indicates the ease of use within service level brackets (unimproved facility to unimproved facility). With residents seeking to own private toilets regardless of service level, the quality of the facility owned could be accounted to cost.

In summary, in order to truly meet and achieve the intended benefits of SDG targets towards eradication of open defecation towards improved health and well-being in the peri-urban, the duality of peri-urban sanitation must be addressed. Whilst improved sanitation facilities hold some benefit, the current sanitation systems used in peri-urban Lusaka, Zambia do not fully cater for the needs of the urban poor, women and girls, being inaccessible by cost and, gender

and social dynamics respectively.

5.2.2 Recommendations for peri-urban sanitation

As indicated in the WHO-UNICEF Core Guidelines, sharing of toilets is a plausible solution for high density sanitation. Interventions focused on collaborations between households for the procurement of improved shared toilet facilities would aid in a move towards improved sanitation access (Tidwell et. al. 2019; Yogananth & Bhatnagar, 2018) [12,31]. Creating collaborations would tackle aspects of improved toilet construction and maintenance for joint, landlord and public toilets. With results indicating a recognition and willingness by residents to own toilets despite monetary constraints, financial strategies such as pooling of funds and payment plans can be considered/encouraged for the urban poor, aiding towards the procurement and construction of improved private, shared and public toilet facilities. Considering the high cost that current toilet models already have despite their inability to cover all user requirements, greater value would be gained by users for a model that, despite costs, can cover all required needs. More so, when used by neighborhoods as public facilities, these models could become sources of communal income. Similar systems could also be trialed for communal drinking water and handwashing improvements.

With peri-urban WASH proving to be quite communal (shared facilities) rather than private (per household), a WASH ladder for high density areas might prove beneficial, taking into account facility management, and common cultural, demographic needs and differences. As this study

primarily focused on peri-urban sanitation, a High Density Sanitation Ladder (Fig 9) was created for consideration through amending the 2017 WHO-UNICEF JMP sanitation ladder (changes to the original ladder are indicated in bold) (WHO & UNICEF, 2017).

HIGH DENSITY SERVICE LEVEL	DEFINITION
SAFELY MANAGED	Use of improved private or shared facilities, usable by all toilet users, at all times (no co-use of unimproved sanitation) with an available responsibility plan or rota and where excreta are safely disposed of in situ or transported and treated offsite
BASIC	Use of improved private or shared facilities, usable by all toilet users, at all times (no co-use of unimproved sanitation) with an available responsibility plan or rota
LIMITED	Use of improved private or shared facilities
UNIMPROVED (No change)	Use of pit latrines without a slab or platform, hanging latrines or bucket latrines [Chambers come here]
OPEN DEFECATION (No change)	Disposal of human faeces in fields, forests, bushes. Open bodies or water, beaches or other open spaces, or with solid waste [Depending on disposal, chambers come here]

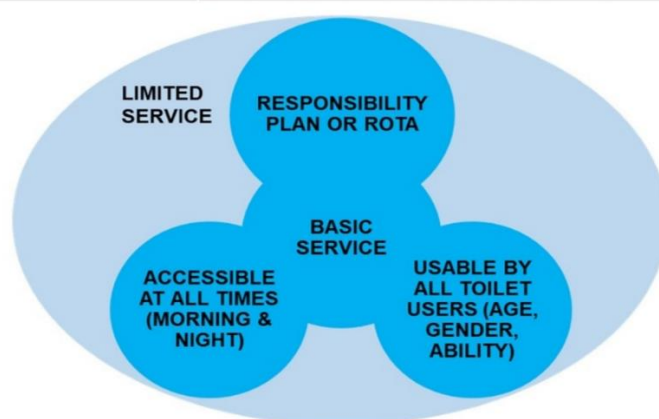


Fig 9. Recommended high density sanitation ladder (WHO & UNICEF, 2017)

The ladder incorporates the unique sanitation needs in high density areas through taking note of universal use, complete access and sanitation management regardless of toilets private or shared status. That said, private/shared status has no impact on sanitation level in the suggested model. The upgrade from limited to basic is based on the limited facility being usable by all toilet users, at all times (no co-use of unimproved sanitation) with an available responsibility plan or rotation. The upgrade from Basic to Safely Managed contains all these plus fecal

disposal as per the original 2017 WHO-UNICEF JMP model. Further studies can be done to look at water and hygiene in high density areas. Additionally, more intervention studies can be done to look into the possible benefits of using social pressure for the improvement of shared sanitation.

Based on the health impacts of chamber use and its similarities to open defecation, future assessments to determine progress on open defecation should consider all modes of household sanitation including chamber use regardless of households' available sanitation facility. This will help in tackling all forms of unimproved sanitation simultaneously to avoid shifting within sanitation ladder brackets and rather, encourage upgrading.

5.3 Enablers and barriers to community-based WASH&W intervention

Analysis of the 11 cases revealed six (6) themes in relation to enablers and barriers to community-based intervention focused on WASH&W, namely tools, relevance, feasibility, collaboration, bureaucracies and access to target. The discussion shall break down each theme in relation to the cases, highlighting the level of their impact on community-based intervention and subsequent implications to peri-urban ecology.

5.3.1 Tools

Tools included materials needed to conduct the intervention such as work equipment, work site, knowledge, finance and education tools equipment and manpower needed to conduct the

intervention, e.g., waste management and education tools. Tools were registered at all levels of the ecological theory.

Education tools created and mastered by DL through photovoice and artwork activities proved to be effective. As the data were generated locally, they were relatable and findings were reused and/or referred to on several occasions (C2, C3, C5, C7). It proved to be a suitable, simplified public teaching aid, enhancing engagement across the ecological model. The Sanitation Exhibition also revealed the methodology as a suitable triggering tool, garnering interest and motivating the target audience, civic leaders and attending organizations towards partnership and action.

Photovoice has been used to engage communities, advocate for and enhance community health and wellbeing (Budig et al., 2018; C. C. Wang, 2006). The methodology was taught to DL by the researcher, and it's easy adaptability allowed DL to intervene from a wealth of knowledge on peri-urban WASH&W (Davis et al., 2018). This highlights the benefits of collaboration in not just solution ideation, but also WASH&W data collection, deepening opportunities for local engagement. Use of the right tools allowed for community participation in the full process of data collection, analysis and further intervention, and as such, empowered DL to speak and engage leaders and stakeholders on their own behalf as equal partners.

The use of photovoice was not without cost. To afford intervention, low-cost, sustainable interventions need to be recommended, e.g., substitution of photovoice with artwork. DL

members often focused on waste management due to the possibility of raising funds through recycling, making it a low-cost, income generating intervention. Such interventions would also assist locals in cases where public services are limited or non-existent, e.g., the general lack of official dumpsites in peri-urban settlements (Nyambe et al., 2018). There is need for more low-cost WASH&W business ideation to locally enhance the value chain.

5.3.2 Relevance

Relevance focused on the need for and interest in the intervention by the target. It also encompassed participant motivation and national policies. Key enabling sub-themes were the need for intervention, and interest and motivation from target audiences. Interventions with the highest enabling score were C2 and C5. C8 was the only intervention registering barrier scores under this theme, carrying poor interest and participation from the target audience and collaborators. Relevance was registered at all levels of ecological theory except organization.

Much interest was paid to the fact that children and youth made up DL, and members were key participants, taking central stage in dealing with WASH&W intervention. Similar to the UNSDGs push for sustainability through partnership with young people (To & Action, 2016), local residents and civic leaders also offered support to their endeavors on the same principle.

The key involvement of children and youth was looked at as preventative, promoting improved KAPs relating to WASH&W education through active learning and participation. These factors have also been considered in child inclusive approaches such as SLTS (Joshi et al., 2016; Unicef,

2012).

More so, as stated under Tools, DL knowledge and research of the target area allowed for relevant intervention and ideation, promoting and thus, enabling broad participation. Despite intervention relevance however, interventions found to be inconvenient in terms of time, venue and participation needs, or with limited gain to target audiences, media and/or civic leaders had less participation. This calls for consideration of the key target audience during planning.

5.3.3 Feasibility

Feasibility focused on the ability to conduct the intervention, encompassing skillset, intervention scale, planning and limitations (in this case, DL member available time and schedules). Feasibility had a high barrier score primarily due to a mismatch between DL skillset and planned scale of interventions. In cases where DL skillset was high due to prior experience (C2, C3, B1, B2, B3), in-case enabler feasibility scores were over 50%. This can be credited to the use of photovoice and artwork for data collection and analysis. Feasibility was a significant factor in intrapersonal and organizational levels of ecological theory.

DL interventions were split between WASH&W education (C2-4, C8), and waste collection/clean-ups (C1, C5-7). All bonus interventions (B1-3) focused on waste management (both clean-ups and education). These interventions were decided and/or agreed to by DL members due to the belief that they were feasible. WASH was only tackled through education; no practical WASH action was taken to improve intervention areas. This could be because of

the costly infrastructural nature and requirements of WASH (Satterthwaite, Mitlin, & Bartlett, 2015). Recommendations of this nature were thus focused towards government.

Clean-ups were seen as simpler, more actionable ways of intervention, requiring less skill level, know-how and planning. They were also easier understood by target audiences, increasing public participation. Additionally, waste collection for the most part, could be done in the public arena without the need to request access permissions from households and/or institutions. Unfortunately for the peri-urban intervention sites, official dumpsites were not available (Nyambe et al., 2018). This meant that minus the ability to pay high service fees, or suitable collaborations, residents could only offer partial/short term intervention in waste management, i.e., a lack of systematic means for intervention. For DL, all waste interventions involved either a waste collaborator (B1, C6, C7, B2), or the provision of an unofficial disposal site (C1) by the target audience. The lack of access to service sites was addressed under 'Tools'. Residents must therefore, be made aware of acceptable, affordable alternatives to lacking government provided services.

5.3.4 Collaboration

Collaboration focused on intervention cooperation between WASH&W stakeholders including DL. It incorporated the sub-themes of grants, responsibility sharing, means of engagement and working reputation. The need for varying skills (responsibility sharing), grants, and a good reputation promoted collaboration. Relevance to collaborators, and policy and considerations

towards DLs young demographic supported this. Interventions ranking high in collaboration scores were C3, C5, C7, C8, whilst C6 and C7 had the highest barrier scores under this theme.

The key barriers in the 2 interventions were challenges in responsibility sharing through no shows and poor time management. The financial cost of setup and time allotment for civic leader participation was high, causing program delays. Collaboration was a significant factor at community and policy levels of ecological theory.

Collaborations reduced intervention costs, increased intervention reach, allowed for greater resident participation and offered social opportunities to DL and target audiences. It also created a track record for DL as they received invitations to other waste management interventions.

Collaboration proved to have positive effects not only on intervention feasibility, but also on the DL members by expanding their reach, knowledge and skillset. Without collaborations, clean-up interventions would have been incomplete, with official dumpsites in intervention sites being unavailable (Nyambe et al., 2018). Collaborations with the researcher allowed for DL members to present their research findings and dialogue with WASH stakeholders at ZAWAFE 2018 (C3). All bonus interventions (B1-3) allowed for DL collaboration with waste management stakeholders; they inspired member intervention (C6-7) and helped to build the DL business plan (C5). Through collaboration, DL proxy participation in the global Hult Prize competition was possible. The business idea made it to the finals of the 2nd stage.

Research has several examples of workable interventions developed by experts which failed

due to the target markets unwillingness to use them (Kennedy-Walker, Amezaga, & Paterson, 2015). WASH&W management have fortunately had some success using interventions created through professional and local resident collaborations, and PPPs (Satterthwaite et al., 2015; Wilbur & Danquah, 2015). Research has also found that collaborations with residents offer empowering platforms that can support solution ideation, intervention and behavior change (Sphere Association, 2018; Satterthwaite et al., 2015). The platform offered to DL allowed for learning, networking and open dialogue with leaders about WASH&W problems affecting their communities. Failed collaborations however, showcased what happens when actors fail to deliver and/or services are not available for whatever reason; an impact to community level norms and values as per the current state of peri-urban WASH&W management stated in Chapter II (cf. Kennedy-Walker, Amezaga, & Paterson, 2015).

5.3.3 Bureaucracies

Bureaucracies encompassed formal documentation, requirements and protocols needing to be fulfilled for WASH&W intervention to take place. This included dealing with hierarchical, monopolized and/or highly bureaucratic systems. Scores towards this theme primarily showcased formal letters of introduction to collaborators, media houses and civic leaders, and permission requests for intervention (e.g., police clearance). In general (though not reflected in the scoring), the more the requirements and their complexities, the more difficult it was to conduct the intervention due to costs and process. Multiple application requirements for access

to a single service (C7), or limited access monopolies and information sources were common barriers to intervention, particularly in business development (C5). When civic leaders were involved (C7-8), protocols often became barriers. Bureaucracy was a significant factor at organizational and policy levels of ecological theory.

Bureaucracies prompted a need for information to plan interventions and ability to fulfill requirements. Documents, fees and permissions had to be submitted, paid and obtained respectively. The Sanitation Festival (C6-7) required clearance from the LCC for disposal of collected waste at the official dumpsite; the Sanitation Exhibition (C2) needed clearance from the local health centers in both sites due to the cholera outbreak that was present at the time of intervention. Respect to Public Health requirements such as handwashing and toilet access for attendees at sites was also notably required.

In order to intervene in WASH&W management, DL members had to visit several different offices for various forms of clearance and information. Unfortunately, simplified, compiled information and guidance was unavailable for the most part; this meant intervention in WASH&W would require a level of experience in the system for smooth and efficient planning. In the case of policy documents, language used had a lot of jargon and was primarily in English making access to information difficult for child members and youth with poor English literacy. Note that Zambian literacy in any official Zambian language including English stood at 75.3% (CSO, 2016). Other than policy documents, simplified standard guides indicating basic

requirements for WASH&W management were lacking, leaving residents without necessary information. Child friendly information was for the most part, lacking.

The participation of civic leaders, primarily as Guests of Honor (GoH) called for a high table to be set up; a tent for outdoor interventions, submission of a speech, program of interventions and public address system were some of the items required at the cost of DL. In some instances, GoH covered certain requirements. Even so, for grass root organizations, the cumulative costs of civic leader attendance are quite high. In addition to the costs, having civic leaders in formal attendance incurred time delays to intervention commencement. In 2 cases, interventions delayed commencement due to late arrival of the GoH. In 1 case, the GoH was a no show.

5.3.1 Access to target

Access to target focuses on the interventions ability to reach the target audience. The theme had the highest barrier score overall. This was primarily due to minimal pre-event communication with and incentives for the target audience. Other pertinent barriers to intervention were the request for handouts from target audiences, occasional use of enclosed/hidden venues and in one case, lack of trust from target audiences (C6). Access to target was a significant factor in intrapersonal, interpersonal and community levels of ecological theory. Communication, venue and inclusivity sub-themes were mainly viewed as enabling whilst handouts were mainly seen as barriers.

There is a need for clear and simplified health information flow to ensure intrapersonal

assimilation. To assure this, WASH&W organizations must provide conducive venues for target audiences and consider jargon and means of communication through using relevant tools for information sharing. Relating to health, several studies have mentioned how lack of trust and poor information dissemination led to refusal of vaccine intake by target audiences (Heyerdahl et al., 2019; Peprah et al., 2016; Pugliese-Garcia et al., 2018). This was also the case in the 2017/2018 cholera outbreak in Lusaka. Even amongst persons that took vaccinations, there was fear, misinformation and misunderstanding on side-effects and potency duration. (Heyerdahl et al., 2019; Pugliese-Garcia et al., 2018).

Focus group discussions with residents in locations where vaccinations were offered highlighted participants' preference for improved environmental preventative methods rather than vaccinations (Heyerdahl et al., 2019). These findings are a reminder to researchers and professionals, of the need for collaboration and engagement with target audiences pre-, during and post intervention to ensure acceptable, socially acceptable interventions are developed and/or embraced. Increased collaborations between professionals and in-group organizations beyond top-down approaches are recommended.

Pre-event publicity through word-of-mouth, flyers, posters and brochures also worked to enable access to the target; it however, didn't guarantee actual participation. The target audience request for handouts/incentives proved to be a barrier to intervention. Whilst some benefit has been found in the supply of incentives during health promotion activities, it doesn't stand

without ethical queries (Gram, Daruwalla, & Osrin, 2019). Target audience assumption of DL assumed the group's ability to intervene was based on a form of external aid/financial backing. In several interventions (C2, C5, C6, C8), incentives were openly requested by the target audience at times, before participation could be confirmed. This was not only done by residents towards DL members, but also by DL members when invited for interventions.

UNICEF, in the development of CLTS, recognized and considered the need to cut incentives for intervention and find other triggers to spur action towards rural residents constructing their own toilets. CLTS therefore, required for the instilling of guilt and shame in residents to prevent the act of open defecation, and subsequently promote resident toilet construction to avoid social stigma (Bateman & Engel, 2018). Whilst the methodology has had success, the use of shame has been questioned and in some communities, rejected (Bateman & Engel, 2018).

5.3.2 Summary and recommendations for intervention in Peri-urban WASH&W

A look at the barriers and enablers towards community-based WASH&W intervention indicates a need for self-sustaining interventions, increased collaborations between experts and local resident organizations, and lighter regulations to encourage local intervention.

For areas like the peri-urban which lack several accessible local WASH&W systems, subsidies and lighter requirements on resident intervention may be helpful to encourage community action and best practice. This was the case during Sanitation Festival Day 1 and 2 (C6-7) in which the LCC offered free waste disposal to support community intervention and ensure that

actions followed best practice.

For improved engagement allowing two-way communication and integration from policy to intrapersonal level, the ideal CBO structure should be registered (Bureaucracies) and have access to tools for intervention. As CBO's, they should be abreast with the state and need of their area of residence; this would allow the interventions to maintain relevance and motivate target audiences need for engagement. To improve the quality of intervention and ease the burden on residents, CBOs should have higher access to collaboration with less red tape and more inclusive tools for engagement. Lastly, being in-group members of their communities would allow for interpersonal access and ease of more inclusive information sharing.

CHAPTER VI

CONCLUSION & RECOMMENDATIONS

6.1 Overall Conclusion

By way of ecological theory, this study described and analyzed peri-urban WASH&W management. Whilst the study initially focused on WASH and diarrhea prevalence, PAR conducted with DL members added waste management to study focus as a vital component in understanding and tackling the challenge of peri-urban WASH and diarrheal disease.

Cumulative findings of the study highlighted breakdowns within the peri-urban ecological

model that maintained the WASH&W status quo and blocked resident interventions. Aspects such as the lack of incorporation of peri-urban residents into community organizations at leadership level, and the lack of policy implementation and regulation proved to be deterrents to improvements in peri-urban WASH&W.

A key finding was the need for WASH&W education. From the broad ecological view, poor KAPs were found to promote poor practice, creating health hazards. However, even in situations where households had improved WASH facilities, diarrhea prevalence was high. Multiple users of facilities proved to have a greater impact on diarrhea prevalence. Both findings reiterate the communal nature of peri-urban WASH, transmission of fecal pathogens and the need for communal solutions. Engagement approaches focused on communal solutions would more likely increase inclusiveness as WASH&W facilities would have to be considered beyond an individual household as per the case of high density areas. An inclusive model would allow for greater engagement from at risk groups, including children and youth. Photovoice and artwork proved to be a good means towards triggering of target audiences.

A promising link between this finding and the study on enablers and barriers is communal engagements link to collaboration for the purpose of policy implementation, regulation and solution ideation. Platforms for local engagement with WASH professionals would help to build trust and allow communities to use WASH&W research to find socially acceptable solutions.

6.2 Limitations

1. Due to the overall weight and volume of the study, several research findings could not be discussed in this thesis, e.g., children's art research on peri-urban WASH&W management. As such, despite child involvement, this thesis focuses primarily on youth participation and activities.
2. Whilst the study method falls under community-based action research, the primary participants are children and youth making findings of the analysis of enablers and barriers to peri-urban intervention more applicable to youth participatory action research rather than the broader community. For a broader understanding of peri-urban WASH&W management intervention enablers and barriers, a more inclusive demographic would need to be involved.
3. Due to the primary participant demographics, in case differences and cross-cultural differences amongst others, it is not possible to generalize these findings across all national and international peri-urban settlements.
4. A deeper evaluation of drinking water and handwashing service levels can be made for a better understanding of diarrhea prevalence at household level. Furthermore, the sufficient yet small household sample size would mean that a larger, more spread out sample may grant more detail about the nature of peri-urban WASH. Cross-sectional studies conducted at a different time point may also give more information on household diarrhea prevalence.
5. With the fluidity of DL member participation, more in-depth pre- and post-test analysis of

the participants was scanty, and therefore difficult to assess at the intrapersonal level.

6. Unfortunately, the study did not measure impacts of DL interventions to peri-urban WASH&W and diarrheal disease in the research sites.

6.3 New insights

In order to complete the final objective of the study: use cumulative findings to develop new methodology suitable for Lusaka peri-urban WASH&W intervention involving all actors (primarily young people), the preceding objectives and findings of the overall research are summarized in the table 12.

Table 12: Objectives, findings and recommendation summary

Objective	Summary
1: Chapter 2	Work with young locals to identify factors defining peri-urban WASH and analyze the peri-urban WASH ecosystem via ecological theory
Finding	Peri-urban WASH&W definition: Poor practice, Health hazard, Substandard & unregulated, Hope for change (intra-/interpersonal level)
Recommendation	Community engagement (covering the whole ecological spectrum)
2: Chapter 3	Identify specific factors influencing peri-urban WASH and diarrhea prevalence at intra- and interpersonal levels
Finding	Diarrhea prev = Improved sanitation, unimproved sanitation, many users
Recommendation	Communal focus for peri-urban WASH = opportunity for inclusive, cost effective and healthier WASH. WASH education required
3: Chapter 4	Identify barriers and enablers to community intervention in peri-urban WASH&W management
Finding	Collaboration, tools (enablers); Access to target, feasibility (barriers)
Recommendation	Local CBOs: Increased equal partner collaboration throughout the intervention process for access to target, culturally acceptable ideation, breaking down of barriers

Based on thematic analysis and ecological theory breakdown, figure 10 gives the breakdown of a new approach for child-youth involvement in peri-urban WASH.

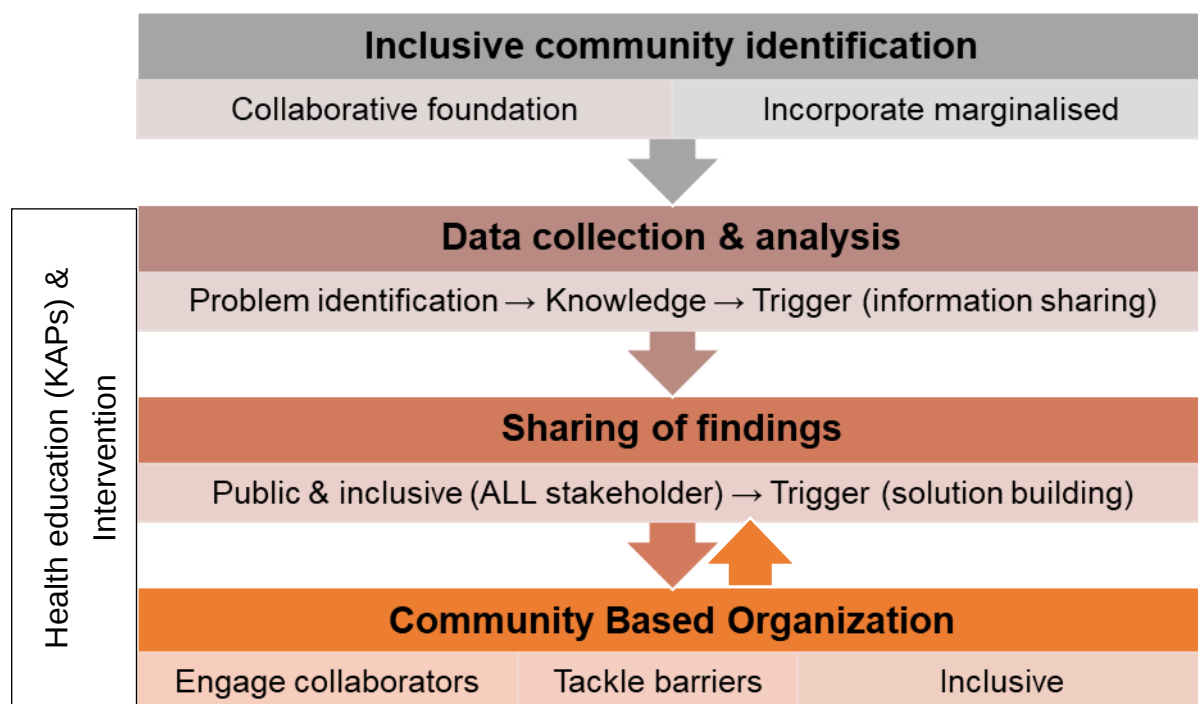


Figure 10: New child-youth peri-urban WASH Approach

As per figure 10, an ideal child-youth CBO can be formulated allowing two-way communication and integration from policy to intrapersonal levels. Crucial aspects to be involved in the model are for key participants to be local residents of the peri-urban settlement they are representing as experts and equal level collaborators, not just recipients. Local representation offers in-group access, and a depth of sociocultural knowledge on the target audience and local WASH&W challenges. These aspects in turn, help to ensure that interventions are relevant to the target audience.

For success, collaborations between local CBOs, experts and other WASH stakeholders are crucial. Collaborations increase opportunities for joint problem-solving and solution ideation, increasing the WASH value chain. They also increase CBO intervention feasibility and increase access to affordable tools and platforms for grants and finance. With supportive collaborations, CBOs would benefit from more platforms for business development, local research funds. Policies aimed at WASH stakeholders requiring sufficient local representation, and/or ensuring clear research feedback is given to areas where research has been carried out will help improve collaboration and local voice. It will also improve information sharing from policy, community and organization levels to intra- and interpersonal levels.

6.4 Contribution to Public Policy, Health Sciences and Research

This research draws attention to the reoccurrence of diarrheal outbreaks in peri-urban settlements in Lusaka, Zambia. As diarrheal diseases are for the most part, treatable and preventable, more can be done. Based on study findings and outcomes, the research recommends for the instatement of inclusive child-youth WASH CBOs in outbreak prone areas to allow for sustainable and proactive solutions to WASH. Moreover, data collection and sharing of findings should be done to keep local communities informed, included and empowered. This will help to increase the pairing of hardware instatement and education.

For High Density Areas, Formal Communal Guidelines are needed that take into account shared/communal facilities. This will allow for communal solutions, e.g., village banking

(Mumba & Lusaya, 2019). It may also help health workers and researchers manage other disease outbreaks, e.g., COVID-19, and plan suitable health promotion activities based on the unique status of the peri-urban, e.g., WASH access and social distancing (Wasdani & Prasad, 2020; Adiga et. al, 2017; Corburn et. al, 2020). Lastly, working with CBOs and approaches might be helpful to empower and create a better work atmosphere for health care providers in the roll out of vaccines in the midst of fear and misinformation (Jones, 2020; Ali, 2020; Banerjee, 2020).

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