

Sanitation access, knowledge and practices gaps in urban informal settlements and their perceived effects on household's livelihoods in Mathare slums, Nairobi City County, Kenya.

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Abstract

Background: Sanitation access in Kenyan's urban informal settlements is still low owing to the challenges of high, uncontrolled urbanization estimated to 1.2- 5% annual growth, low profile on sanitation compared to other services like water and governance issues such as institutional fragmentation, coordination issues and low fiscal allocations, research gaps and inadequate commitment leading to low actual expenditure in the sector. The study collected data on household's sanitation access, knowledge and practices and analysed data on how sanitation access, knowledge and practice gaps affected household's livelihoods in Mathare slums in Nairobi City County, Kenya.

Methods: Quantitative and qualitative data were collected for this study with a sample size of 155 respondents/ household's heads/ members and medical records from four medical clinics analysed. The researcher used questionnaires, face to face interviews and observations for collection of primary data, and a mobile data capture platform (Kobocollect) was utilised.

Results: This study showed that the average household's sanitation access for the study area is 50%, with another 45% using public toilets, while 4% borrowed from neighbours, and 1% used buckets or paper bags; access to toilets (pour flush and water closets) was at 44% while sewer connection was at 40%; majority of the households had some background knowledge on the linkage between diarrhea and personal hygiene and sanitation, although knowledge and practice gaps on the causes of diarrhea and practices to prevent it, such as use of toilets and water treatment were found. The low sanitation access coupled with knowledge and practices gaps were found to have a significant impact on household's livelihoods. Economically, households were found to spend part of their income to access sanitation in public toilets, and also to cater for medications due to frequent diarrheal related ailments. Sanitation-related morbidity and mortality also impacted on household's productivity and loss of income opportunities. Poor sanitation also exposed household members, mainly girls and women to rape, theft and physical injuries as well as poor quality of life and standard of living.

Conclusions: The study states that poor sanitation, knowledge and practice gaps are associated with household's livelihoods. Diarrhea and other sanitation and hygiene-related diseases are the second leading contributor to morbidity rate for under five years and the third leading cause of morbidity for over five years in the study area. Frequent hospitalization impacted negatively to household's income through reduced productivity, increased expenditure due to medication, reduced asset base and saving due to a limited choice between purchasing food, medicine, paying for sanitation access and purchasing fixed assets. Sanitation access, was therefore, found to impact directly on household's livelihoods through direct costs to pay for sanitation access, cost of medication and reduced productivity due to sickness.

Keywords: Households, hygiene, Kenya, livelihoods, Mathare slums, Nairobi City County, Sanitation.

1. INTRODUCTION

The Sustainable Development Goal (SDG) no. 1 envisioned at a world with its people, including those in extreme poverty and the most vulnerable, to enjoy a basic standard of living and social protection benefits by the year 2030 (UN, 2016, p. 3)[1]. Sanitation access is one of the vital aspects that sustain a good standard of living, for "It contributes to better human health, dignity and quality of life" according to (GOK/MOH, 2016) [2]. Access to improved sanitation, complemented with access to safe water and proper hygiene, contributes significantly to good health and livelihoods and lack of good health is closely linked to poverty (Hussain et al, 2002) [3].

Inadequate access to water, sanitation and hygiene (WASH) has been estimated to cause nearly 1.7 billion cases of diarrheal diseases annually, across the globe, resulting in about 2.2 million deaths, mostly children in developing countries (WHO, 2013)[4]. Summing up the multiple effects on public health, WHO estimated that unsafe Water, Sanitation and Hygiene (WASH) was responsible for nearly one-tenth of the global disease burden, (Prüss-Üstün et al, 2008)[5]. In Kenya, about 80% of hospital attendance has been found to be as a result of preventable ailments, with 50% of these diseases related to poor sanitation and hygiene (GOK/MOH, 2007)[6]. This disease burden is mainly borne by the poor, owing to unsafe drinking water, limited sanitation infrastructure and poor hygienic practices (Jacob et al, 2010)[7]. World Health Organization(WHO) studies carried out in early 1990s indicated that the median reduction in morbidity for diarrhea, trachoma, and ascariasis induced by sanitation and/or water supplies was 26%, 27% and 29%, respectively, while those for schistosomiasis and dracunculiasis was at 77% and 78%, respectively (Esrey S.A. et al, 1991)[8]. Further also, systematic

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reviews have shown that improvements in access to sanitation and water can result in a 20 – 40% reduction in diarrhea burden among children less than five years (OECD, 2011)[9].

The Sustainable Development Goal (SDG) on Water, Sanitation and Hygiene endorsed in 2015 committed the countries of the world to achieve a universal access of “ensuring availability and sustainable management of water and sanitation for all” (UN, 2015 Goal No. 6). The Sustainable Development Goal (SDG) No. 6 is a major improvement to MDG goal No. 7 according (ICSU, 2015)[10], one of the major improvement being the inclusion and monitoring of hygiene practices (such as handwashing with soap and menstrual hygiene management) and WASH access beyond the household setting (schools and health care facilities) (UNICEF/ WHO, 2015)[11].

Report by (WHO/UNICEF, 2017)[12] on progress on sanitation indicated that 2.3 billion people had no access to basic sanitation services with 892 million practicing open defecation and another 856 million using unimproved sanitation facilities such as pit latrines without a slab or platform, hanging latrines or bucket latrines. The report further indicated that about 600 million who had improved sanitation facilities shared with other households therefore classified as having a limited access to sanitation services. On global progress towards universal access by 2030, (WHO/UNICEF, 2017)[12] indicated that “no SDG region was on track to achieve universal basic sanitation by 2030, with the exception of Australia and New Zealand, where coverage is already nearly universal”.

A report on sanitation access in Kenya released in June 2015 reported that 57% of Kenyans used improved or shared sanitation facilities (79% in urban areas and 49% in rural areas) while 12-14% had no access to sanitation facilities and were still practicing open defecation (3% in urban areas and 15% in rural areas) (UNICEF/WHO, 2015)[11]. Poor sanitation access mainly affects the poor population, according to (Wasonga et al, 2014)[13] living in the informal settlements, peri-urban and rural areas, where open defecation practices, lack of improved sanitation services and use of unsafe water persists, knowledge gaps, which hinder them from practicing basic hygiene. This condition has led to high prevalence of diarrhea and other sanitation-related diseases. For instance, a study carried out by African Population and Health Research Centre (APHRC, 2002)[14] showed that the prevalence of diarrhea among children below the age of 3 was around 40% in Kibera slums, whereas it was much lower in Nairobi as a whole (13%) and at national level in Kenya (17%).

In sub-Saharan Africa (SSA) region, the progress towards achieving universal access to improved sanitation is still low. For instance, in terms of reducing open defecation, (WHO/UNICEF, 2017) [12] reported that the population practicing open defecation increased from 204 million to 240 million from 2000 -2015. Overall, sixteen of the 24 countries had at least one in five persons having limited sanitation services (facilities shared by more than two families), especially in urban areas. This regional trend in sanitation access is mainly influenced by the challenge of rapid population growth

(WHO/UNICEF, 2017) [12], coupled with high, uncontrolled urbanization estimated to 1.2- 5% annual growth, which has led to increase in slums populations (UN-Habitat, 2006) [15]. The resulting phenomenon has created a huge pressure on the existing basic urban services such as water and sanitation access.

Another key factor influencing sanitation access in the region is linked to social-cultural and economic marginalization based on aspects, such as ethnicity, religion, economic class, social status, gender, age or physical abilities which limit people from accessing land and water resources and related services (WWAP, 2015)[16]. Such exclusion creates a long-term vulnerability with both social and economic effects, leading to perpetual poverty. (UN-Habitat, 2008)[17] Notes that improvements in water and sanitation access is probably the most important factors in poverty and inequality reduction especially in urban areas.

One key reason why sanitation access has remained low despite many national and international programs is the low profile on sanitation compared to other services such as water (IRC, 2007)[18]. The reasons for low profile according to include lack of collective aspirations to improve sanitation in rural and low potential urban areas resulting to low demand for sanitation services (Scott and Govindan, 2003), distrust on the sanitation services (public or private) due to sub-standard services provided especially to the poor, low return by providers of sanitation services compared to other services such as water making sanitation business unattractive (Crennan and Berry, 2003), low financial allocation for sanitation services development, and weak policy and institutional framework resulting to low action on the ground (GOK/MOH, 2016)[2], (SACOSAN, 2003), (IRC, 2007)[18].

Governance issues are also noted to be a major challenge facing the sanitation sector. Some of the governance challenges facing sanitation development in sub-Saharan Africa according to (Nelson Ekane, 2014)[19] include: weak co-ordination mechanisms among key stakeholders, poor integration of water, sanitation and hygiene issues (WaterAid, 2011), research gaps, inadequate commitment and actual expenditure in the sector (UN-Water and World Health Organization, 2012), supply and technology driven interventions rather than demand, capacity and knowledge gaps on sanitation and hygiene, weak institutional and legal frameworks, lack of focus to the urban poor (Nyonyintono Lubaale, Musembi Musyoki 2011) and unsustainability of sanitation interventions (in Ekane et al. 2012), (Ekane and Gill, 2013). The other major bottleneck is the lack of capacity to translate policies to real practice owing to socio-cultural and economic factors which shape prevailing behaviour and practice (Nelson E et al, 2016)[20]. In Kenya, institutional fragmentation, coordination issues and low fiscal allocations has been noted as some of the main challenges facing the sanitation sector (GOK/MOH, 2007) [7].

Mathare Slums is the second largest Informal settlement in Nairobi city, characterized of widespread overcrowding, so-

cial and economic marginalization, poor environmental conditions, insecurity and near absence of basic social services, (APHRC, 2014)[22]; High poverty levels, with incomes estimated to between Ksh. 3,000 (NCWSC/AWSB, 2009)[23] and Kshs.8,500, with over 30% earning less than Ksh. 5,000 (MUST, 2011)[24]; Over-urbanization due to rapid population growth, shortage of affordable, decent housing and uncertain land tenure attributed to the illegal nature of slums settlements, further shrinks the incentive to improve the surrounding leaving the urban poor almost excluded from governments' development and service delivery plans such as water and sanitation services, (Abdulla et al, 2011)[25]. The study was focused on 4 wards in Mathare slums namely Mlango Kubwa, Ngei, Hospital ward and Mabatini.

2. LITERATURE REVIEW

The literature reviewed in this study focused on sanitation access and livelihoods and health linkages.

Sanitation and livelihood linkages

Sanitation access (together with Water and hygiene) plays a key role in "relation to human health, livelihoods, economic growth as well as in sustaining ecosystems" as declared by International Conference on Freshwater declarations held in Bonn in 2001 (Reba, 2003)[26]. Poor access to water and sanitation has an effect on health, productivity and physical safety of the poor. Firstly, there are several approaches to defining livelihood. For instance, (Chambers and Conway, 1992), (IRC, 2007)[18] defined livelihood as: "A livelihood comprises people, their capabilities and their means of living, including food, income and assets. Tangible assets are resources and stores, and intangible assets are claims and access. A livelihood is environmentally sustainable when it maintains or enhances the local and global assets on which livelihoods depend, and has net beneficial effects on other livelihoods. A livelihood is socially sustainable when it helps cope with and recover from stress and shocks, and provide for future generations".

Livelihoods in this case are activities that enhance poor people's means of living including income-generating activities that bring cash income or able to generate in-kind products that add to the monetary income of the households and/or reduce expenditures (IRC, 2007)[18]. Building from above definition, IRC thematic overview paper on "Enhancing Livelihoods through Sanitation" (IRC, 2007)[18] defines livelihood as people's means of survival, which can be affected by the situation in which they find themselves, especially their physical, economic, social, environmental and psychological conditions. Livelihoods in this approach are able to produce income which contributes to improving life conditions and enhance human dignity, can improve family members' health and the immediate environment.

Another approach to livelihoods is the Sustainable Livelihoods framework, which takes an integrated view of how livelihoods are created by integrating the micro-economy of the

individual or household with the macro-level institutional, policy and vulnerability contexts in which they are situated, Ellis & Freeman (2005),(Jensen, 2009)[27]. This approach puts emphasis on the need to understand the poor. For instance, the UNDP Sustainable Livelihood Approach (SLA) endeavours to addresses people in their local context to create an enabling environment so that men and women can optimally use what they are capable of using and let their capabilities flourish (UNDP, 1999) (IRC, 2007)[18].

(IRC, 2007)[18] Suggests a two-way relationship between sanitation access and livelihoods. On one way, sanitation is said to bring a positive impact on the livelihoods of the poor. "Improved sanitation makes its possible for poor women and men to undertake initiatives and mobilise their assets". On contrarily, lack of improved sanitation makes the poor susceptible to water borne diseases hindering them from engaging in productive works. This thought is supported by (WWAP, 2015)[17] study, which deduced that lack of improved sanitation (and water) often leads to recurrent diarrheal and other life-threatening water-related diseases, leading to perpetual weakness and loss of income due to frequent medication and hospitalization. Consequently, poor access to sanitation, in this case, limits the freedom of choice between paying for water, food, school fees or medicines (WWAP, 2015)[17]. On the other side of the coin, improved livelihoods also enhance improved sanitation by the households. Households with more disposable income are able to make improved sanitation a relevant goal to be achieved through their own efforts and or with minimal help (IRC, 2007)[18].

IRC thematic overview paper also paper proposes a broader model that considers the whole sanitation value chain where the poor is involved. i.e disposal of human waste, collection, treatment, transfer, re-use, coverage and management of human excreta. Human waste can be utilised as an asset/ input in productive activities such as agriculture (IRC, 2007)[18] and production of energy. In this model, household's livelihoods can benefit both directly or indirectly, through activities which generate income for instance eco-sanitation which produces fertilizers or benefiting from support such as training to enable them choose the sanitation infrastructure they need, which will eventually bring higher levels of health and hygiene (IRC, 2007)[18]. A study by Practical action in Maili Saba slums focusing on livelihood and gender on sanitation, hygiene and water services found out that Water and sanitation services offer business opportunities to community members/groups employed in managing toilet blocks.

Another line of thought suggests that Sanitation and livelihoods tend to be linked through the impacts of poor facilities on health, safety and time (Practical Action, 2005)[28]. Unimproved latrines in urban informal settlements often lead to contamination of water sources leading to high incidence of diarrhea. Interms of gender perspectives on public sanitation, (Practical Action, 2005)[28] study found out that women were constrained from using improved sanitation facilities e.g. community toilets because of financial aspects related to subscription to use the sanitation block; time spend to walk and

queue for public sanitation blocks and safety concerns for fear of attack and rape. This is also supported by (Joanna P. & Kate M, 2008)[29] Paper on non-health benefits of sanitation which examines the gender, education, disability, economic and environmental implications of sanitation. Improved sanitation at household's level is noted to have time and energy savings effect on women, bringing benefits such as more time for child care, improved domestic hygiene, increased rest time and community development work. Economically the paper notes that sanitation can be a means to empower women, especially those in direct management of sanitation facilities for roles such as operators and committee members.

(UNICEF, 2003), (SuSanA, 2009) [30] study also linked lack of improved sanitation access to poor access to education. This study found that many children, especially girls miss educational opportunities because they are forced to be late or miss school to help their mothers to fetch water. In rural Pakistan, for instance, the study found out that more than 50% of girls drop out of school in grade 2-3 because the schools do not have latrines (SuSanA, 2009)[30]. An evaluation of an intervention carried out by UNICEF Bangladesh in 1994 found that the number of girls increased by 11 per cent in a class of 228 (Joanna P. & Kate M, 2008)[29]. A related research by (OECD, 2011)[9] projected that reduction of diarrhea by meeting the sanitation MDG target would have added more than 200 million days of school attendance per year, leading to increased female literacy. Increased education of girls, in this case, would have had an impact to the economic growth, according to (Bartram, 2008), (OECD (2011)[9], which argued that in a typical developing country, for every 1% increase in female secondary schooling results in a 0.3% increase in economic growth.

In regards to disability, installation of disabled friendly facilities such as handrails, paths and possibly, toilet seats increased school's enrolment by 113 per cent of disabled children over a three-year period in Kenyan schools (Bannister et al., 2005), (Joanna P. & Kate M, 2008)[29]. Installation of toilet set was also noted have a time saving effect for both the disabled and the caregiver [29].

Several other studies also linked sanitation access to household's livelihoods and poverty. For instance (WWAP, 2015) [16], indicated that poverty levels influence the type of sanitation facilities owned by the household. This is because the cost of building a latrine can be prohibitive, in relation to household income in many rural/suburban communities, especially in areas with unstable soil condition, in rocky or high water tables. Sanitation development strategies in this case, should, therefore, consider households income and livelihoods. In this regards, (WWAP, 2015)[16] reasoned that poverty-reduction approach to water, sanitation and hygiene promotion could impact positively the lives of billions of poor people, because of the very direct benefits accrued from improved sanitation services through better health, reduced health costs, increased productivity and time-savings. (MOH/GOK, 2007)[6], also noted that improvement in sanitation and hygiene is significant in poverty alleviation, through jobs creation, utilization of

local resources, improved health and hence increased productivity, skills development and hence the provision of long-term livelihoods.

Poverty-reduction approaches in Water and sanitation was also highlighted by (Alan Nicol, 1999)[31], as an integration which pays a close attention to the link between water/ sanitation supplies and urban and rural livelihoods. This concept proposed the need to integrate poverty eradication into the water and sanitation sector; to address poverty as a livelihoods issue affecting individuals, households and communities. This concept goes beyond evaluating the health benefits of improved water, sanitation and hygiene, but also looking keenly to the establishment of sustainable livelihoods through WASH interventions. This concept proposed key areas of focus such as time-savings and their economic impact at a household level (Churchill, (1989, (Alan Nicol, 1999)[31].

The concept of Poverty-reduction approach to water, sanitation and hygiene promotion was similarly supported by UN-Water report in the United Nations World Water Development Report, (WWAP, 2015)[16], which closely linked Water, Sanitation and Hygiene (WASH) and economic development. According to the report, improved WASH management can contribute to poverty reduction strategy in four dimensions: firstly through enhanced livelihoods security; secondly through reduced health risks resulting from waterborne diseases, such as diarrhea and water-related vector-borne diseases like malaria, thirdly by reducing vulnerability from unsustainable environmental trends and shocks from water-related natural disasters and finally by through economic growth resulting from WASH-related income-generating and business opportunities.

Sanitation relationship to livelihoods was also supported by (Sullivan et al, 2003)[32] where they related poverty, sustainable livelihoods and water poverty index/ sanitation index. Poverty, in this case, is referred to as a deprivation of one or more basic conditions or skills needed for effective living. Lack of access to safe water and improved sanitation according to this concept have a bigger impact on health as well as economic productivity, in relation to time lost in the search for water and sanitation. In relation to sustainable livelihoods framework by (Scoones, 1998, Carney 1998),(Sullivan et al, 2003)[32] development (in this case WASH interventions) should have an impact on livelihood assets or capitals in term of natural, physical, financial, social and human assets.

Sanitation linkages to Health

Lack of adequate access to improved sanitation (together with safe water and hygiene) –WASH is known to cause a large number of diseases, classified into broad four categories: waterborne (due to ingestion of contaminated water, fluids water, such as diarrhea); water-washed (due to poor hygiene practices, e.g. Trachoma); Water-based (transmission through aquatic invertebrate, e.g. such as schistosomiasis) and water-related insect vector routes (caused by insect vector in water, e.g. water, such as for malaria or dengue fever, (OECD,

2011)[9]. Provision of environmental sanitation coupled with water and proper knowledge, attitude and practices on WASH acts as barriers to transmission of both waterborne and water-washed diseases, (Batteson et al, 1998)[33]. Figure 2 below shows oral-fecal transmission route (also called the F-Diagram) together with relevant interventions (barriers) which can be used to in each route.

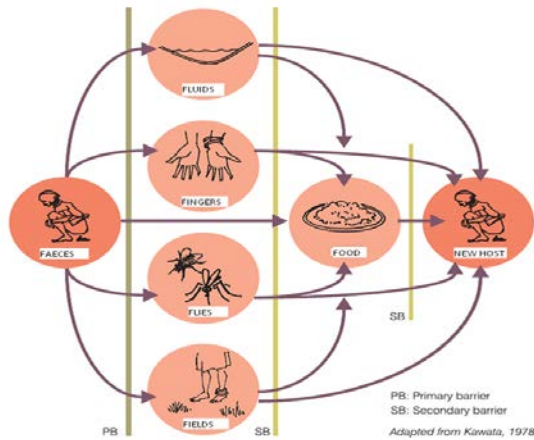


Fig. 1: Transmission of diseases from faeces
Adapted from Kawata 1978, in Batteson et al, (1998)

Sanitation and hygiene (and water) act as both primary and secondary barriers in the fecal-oral transmission routes (Batteson et al, 1998)[33] as below:

- (i) **Primary Barriers (PB):** Improved sanitation, supported with personal hygiene, acts fundamentally 'as a primary barrier' by ensuring that faecal matter is disposed of safely, and does not spread in the environment. Sanitation also keeps away faeces from fluids and fields in addition to preventing the breeding of flies. Faeces-Fingers contamination, on the other hand, can be eradicated by the washing of hands with soap, alcohol or ash in five key times: after visiting latrines/ toilets; after handling children's faeces; before eating; before handling food and after handling animals. (Kaiko, 2009)[34] Also notes that discouraging children from sucking their fingers can also block the faecal-fingers contamination routes.
- (ii) **Secondary Barriers (SB):** these are mainly water-related factors which can aid or prevents faecal-oral transmission in two ways: firstly through water-borne transmission, where contaminated water can cause infection to an exposed new host; and secondly, through water washed transmission, where insufficient water quantities lead to poor hygiene (hand washing), poor food handling and poor environmental sanitation, (Batteson et al, 1998). The two differ in that, while waterborne transmission can be controlled by ensuring water quality, water washed transmission can be controlled by ensuring adequate quantities of domestic water supply. Increasing the quantity of water also has an impact on some other water washed infections like Skin infections (e.g. Scabies, body lice, tropical ulcers) and several eye infections (e.g. Trachoma, conjunctivitis).

Sanitation access is also connected to other infections commonly referred to as Water-based diseases, which are caused by parasitic infections to human, where the parasite spends a part of its life cycle in an intermediate aquatic host, for instance, schistosomiasis (bilharzia) and guinea-worm. These infections can be similarly be eradicated by improved water supply in addition to environmental sanitation.

Sanitation works in complementary with personal hygiene practices such as handwashing with soap. Handwashing with soap at the key times – i.e. after contact with faeces, before handling food and feeding an infant has been shown to significantly reduce the incidence of both acute respiratory infections and diarrhea. A meta-analysis of 144 studies by (OECD, 2011)[9] showed that the median reduction in diarrheal diseases due to improved water supply, water quality, sanitation and hygiene interventions were 27%, 17%, 22% and 33% respectively. Similar studies to assess the impact hygiene intervention on children by (OECD, 2011)[9], involving a meta-analysis of 71 studies (which assessed 130 000 children in 35 countries) showed 31% reduction in child diarrhea morbidity due to hygiene intervention, while the combined effect of sanitation infrastructure and water quality led to 37% reduction in diarrheal morbidity. (Fewtrell et al, 2005),(OECD, 2011)[9] study involving a meta-analysis of 60 studies on impacts of water quality and hygiene, gave a 40% reduction of diarrheal diseases while sanitation and water supply only gave a combined effect of 20% reduction in diarrheal infections.

The three studies suggest an average reduction of diarrheal diseases by 36% due to hygiene-related intervention. However, a systematic review of the effect of handwashing with soap by (Curtis V. A. et al, 2009) [35] gave a higher value of 43% in reduction in diarrheal disease, but its effectiveness is only attributable to a sustained behaviour change (van der Knapp, 2006), (Waddington, 2009),(OECD,2011)[9]. These results show an important scenario, that improvement in water quantity is a critical factor for the adoption of hygienic practices [31]. A household requires sufficient amount of water to habitually practice hand hygiene. This idea is supported in (Batteson et al,1998) [33], who argue that increasing the quantity of water used by households is probably more important than increasing the quality in the reduction of non-epidemic diseases "as washing faecally-contaminated fingers and utensils, even with dirty water, is better than not washing at all".

On a contrasting opinion, (Waddington, 2009), OECD (2011)[9] argues that water quality is the critical determinant of health benefits rather than water quantity. This is supported by (Prüss-Üstün et al, 2008)[5] , OECD (2011) research on point-of-use (POU) treatment solutions which showed a significant improvement on the impact of water supply interventions, with an estimated 45% reduction in diarrheal infections.

Aim of the study

The aim of the study was to assess sanitation access, knowledge and practices gaps and their effects on household's livelihoods in Mathare slums, Nairobi County.

Objectives:

1. To assess household's access to sanitation facilities in Mathare slums, Nairobi County, Kenya,
2. To assess the knowledge and practices gaps on sanitation in Mathare slums, Nairobi County, Kenya,
3. To assess the households perception of the effects of poor sanitation to their livelihoods in Mathare slums, Kenya.
4. Review medical data on incidence of sanitation related diseases in the study area.

3. METHODOLOGY

Study design: Descriptive research design was employed in this study. The study utilized mainly the quantitative techniques to collect data and to deduce the effects of the phenomenon through observations, reconstructions and analysis of the subject matter.

Study area and target population

The study targeted the urban population living in the informal settlements of Mathare slums, covering 4 political wards of the large Mathare constituency: Hospital ward, Mlango Kubwa, Mabatini and Ngei wards, with estimated population of about 50,585 households (estimated 2018), from (KNBS/SID, 2013) [36]. The targeted respondents for this study were the household heads or members of the households who could provide information on sanitation access and social-economic aspects of sanitation at household's level.

The study also involved collection of medical data from the four main medical facilities serving the four wards, namely: Huruma lions health centre (Ngei ward- public), Mathare police deport dispensary (Hospital ward - public), Upendo dispensary (Hospital ward- public) and SHOFCO clinic (Hospital ward-private and donor-supported). The data was used to investigate the main diseases in the area especially those related to sanitation, commonly referred to as water-borne diseases.

Sampling technique

The study employed several sampling techniques. Firstly, the research used the Stratified sampling method, which involved considering each ward as a stratum, assumed to have some distinct characteristics, different from the other. Each of the strata (ward) was sampled as an independent sub-population, out of the sample size was considered. The sample size for each ward was selected based on the proportion of population size and the number of households.

The second process involved the construction of spatial network grids in each of ward as defined by roads and other public amenities. Each grid was assumed to share some common characteristics in terms of sanitation services, sewer connections or housing type. Simple random sampling was used to select samples within different grids until the sample for each ward was completed. Although samples for each ward/ strata was collected, sampling in some areas was somehow affected by insecurity with some sections completely inaccessible due

to direct aggression on the enumerators.

The medical facilities of health (clinics and dispensaries) were purposively selected based on the population they served and nature of the facilities. The public facilities were more preferred due to higher coverage and lower cost compared to the private clinics.

Sample size

The sample size in this research was estimated using (Miller and Brewer, 2003)37 formula below:

$$n = \frac{N}{1+N(\alpha^2)} \dots\dots\dots \text{Equation 1:}$$

Where:

- α = is the level of significance or margin of error
- N = is sample frame
- n = is the sample size

Research Assumptions:

- α - margin of error assumed at 8% (0.08) at a confidence level 92% (owing to limited resources)
- N - Sample frame is 50,585 households

$$n = \frac{(50,585)}{1+50,585(0.08)^2} = 155$$

Data collection tool

Primary data was collected using Kobocollect, mobile-based platform designed to capture data. A questionnaire was first designed covering all areas of interest, then uploaded into KoBoToolbox and validated through a trial data collection process. The data collection was executed with the help of four assistants (enumerators) who were trained and allocated with mobile phones equipped with the data collection tool. The collected data was posted on real time, with the posted data being visible in the researcher's account, showing the exact location of enumeration. This enabled timely data quality checks and feedback, which helped in timely correction of errors.

The questionnaires used were mainly structured, with both closed and open-ended questions intended to produce the required information from the respondents, to help answer the research questions. The questionnaires were carefully designed and pre-tested with a few members of the population for further improvements. This was done in order to enhance validity and accuracy of data to be collected.

Observation was also used as a technique for collecting primary data. This provided information on the availability of sanitation and hygiene facilities as well as the general condition of the environment. Practices such as handwashing with soap, dumping of wastes in waste pits or in the compound were observed. Secondary data was collected through review and analysis of published materials and information from other sources such as annual reports, books/ e-books, journals as

well as internet materials.

Numerical data especially that from the National Bureau of Statistics was used to compare with the research findings.

Pilot study

This pilot test was conducted by the researcher together with the data assistants during the training in the neighbouring ward (Huruma ward) using a sample size of 125 respondents. The main purpose of the pre-test in this research was to familiarize with the respondents and test the suitability of the research tool (questionnaire). The feedback from the pre-test was used to modify the questionnaire to avoid ambiguity in the answers received.

Data entry and analysis

The collected data was posted directly to Kobotoolbox account, then cleaned and exported to Microsoft Excel spreadsheet and Statistical Package for Social Scientists (SPSS) for analysis. The analyzed data was represented using frequency distribution tables, charts and graphs.

Ethical consideration

For this research work, a research permit was obtained from the National Commission for Science, Technology & Innovation (NACOSTI). Further approvals were obtained from the County Education office, Sub-County education office, the County Commissioner's office and the sub-county commissioner's office. Medical health records data were obtained with permission from the Nairobi County medical services and Ministry of Public Health and Sanitation. Verbal informed consent was also obtained from all interviewees. Confidentially was also assured with a declaration that the researcher had no conflict of interest and that the information was purely for academic purpose and personal details were held in total confidence.

Budget

The study was self-funded for academic purposes.

4. RESULTS

Demographic characteristics of respondents

The study included 155 household heads/ members of the households, from four wards: Hospital Ward-24 (15%), Mabatini Ward- 36 (23%), Ngei Ward (Huruma A) – 41 (26%) and Mlango Kubwa -54 (35%). Both male and female respondents were interviewed with 98 respondents (63%) being female and 57 respondents (37%) being male. The respondent's age ranged between 17 years and 68 years. The mean, median and the standard deviation of the respondent's age were 32.6 years, 30 years and 10.5 respectively. In terms of marital status, 64% of the respondents were married while 29% of the respondents were single. The remaining 7% were either divorced/ separated (4%) or widowed (3%). On education level of respondents, 41% of the respondents had only completed primary level (class 8) of education while another 40% had gone up to O level (form 4) of education, with only 7% not being able to read and write. This implied that the majority of the respondents were able to understand and respond to most of the research questions asked by interviewers. The demographic data of the respondents is summarized in table 1.

Table 1: Demographic characteristic of household's respondents

N=155	Variable	Frequency of respondents	Valid frequency	Percent (%)
Gender of Household's respondents	Males	57	57	37%
	Females	98	98	63%
	Total	155	155	100%
Distribution of Age of HH respondents	12-17 years	1	1	1%
	18-24 years	37	37	24%
	25-40 years	87	87	56%
	41-59 years	26	26	17%
	Over 60 years	4	4	2%
	Total	155	155	100%
	Mean=32.6	Median =30	Std. deviation=10.5	
Marital Status of the respondents N=155	Married	99	99	64%
	Single	45	45	29%
	Separated/ Divorced	6	6	4%
	Widow/er	5	5	3%
	Total	155	155	100%
Education level of respondents	Can't read/ write	11	11	7%
	Class 8	63	63	41%
	O level/ Form 4	62	62	40%
	College (certificate/ diploma)	15	15	10%
	Graduate (degree and above)	4	4	2%
	Total	155	155	100%

Respondent's Households characteristics

Gender of the household's heads: 104 respondents, representing (67%) of the respondents indicated that their households were male-headed, while 51 respondents (33%) came from female-headed households. There were no child-headed households sampled by the respondents.

Table 2: Gender of respondent's household head

	Variables	Frequency of respondents	Valid frequency	Percent (%)
Household's head	Male head of Household	104	104	67%
N=155	Female head of Household	51	51	33%
	Total	155	155	100%

Household's size and composition: The household's sizes ranged between 1 and 13 members, with a mean household size of 3.9 persons, median of 4 and a standard deviation of 2.05. The lower percentile (25%) was 3 while the upper percentile (75%) was 5. Cumulatively, 66% of the sampled households indicated to have household sizes of ranging 1-4. On the other hand, household sizes beyond 6 members were very rare, with only 5% of the households having 7 members and more.

Table 3: Respondent's household size and composition

Household size	Number of households	Percent	Valid Percent	Cumulative Percent	Total population
1	20	12.9	12.9	12.9%	20
2	17	11	11	23.9%	34
3	33	21.3	21.3	45.2%	99
4	32	20.6	20.6	65.8%	128
5	23	14.8	14.8	80.6%	115
6	16	10.3	10.3	91.0%	96
7	7	4.5	4.5	95.5%	49
8	3	1.9	1.9	97.4%	24
9	2	1.3	1.3	98.7%	18
10	1	0.6	0.6	99.4%	10
13	1	0.6	0.6	100.0%	13
Total	155	100	100		605
Mean	3.9				
Median	4				
Mode	3				
Std. Deviation	2.05				

Households with children aged less than 5 years: Children less than 5 years are more affected by diarrhea and other sanitation-related diseases hence households with children below the age of 5 years are more affected by lack of improved sanitation at the household level. 48% of the respondents indicated that their households didn't have children aged below 5 years while 50 % of the respondent's households indicated that they had 1 or 2 children aged below 5 years. None of the households had more than 3 children aged less than 5 years.

Table 4: respondent's households with children aged less than 5 years

Household type (N=155)	Number of households	Percentage
Households with no child aged below 5 years	75	48%
Households with one child aged below 5 years	51	33%
Households with two children aged below 5 years	26	17%
Households with three or more children aged below 5 years	3	2%
Total	155	100%

Occupation of the household's head: 64 respondents representing 41% indicated that their household's heads were unskilled/ labourers, while another 31 (20%) said they were business persons (Shopkeeper/clothes vendors, small to middle sized busi-

ness). In addition, 13% (20) of the respondent's household's heads were trade persons such as masonry, carpenters, masons and painters, while those whose household's heads were unemployed represented 10% of the households. The unemployment rate is comparable to Nairobi county total unemployed at 11.1% according to (KNBS/SID, 2013)³⁷ Overall, 61% were either doing unskilled work/ labour or small to medium scale businesses.

Table 5: respondent's household head's occupation

Occupation type (N=155)	No. of respondents household heads	Percentage
Unemployed	15	10%
Unskilled/ labourer	64	41%
Business (Shopkeeper/clothes vendors, small to middle sized business)	31	20%
Tradesman (Mason, carpenter, welder, painter)	20	13%
Skilled worker	15	10%
Middle level professional (Teacher/ nurse)	7	5%
Clerical (secretary, clerk, teller)	3	2%
High level professionals (Engineers, doctors, lecturer etc)	0	0%
Total respondents	155	100%

Level of income of the household head: Majority of the household's heads earned in the range of Ksh 7,501-10,000 (25%). Overall, 61% (94 respondents) indicated that their household's head earned Ksh. 10,000 and below. The level of income at household level determines the ability to pay for social amenities such as sanitation access, water or health care.

Table 6: Respondent's household head income

Income (Kshs.)	Number of respondents	Percent	Valid Percent	Cumulative Percent
Less than 3000	2	1.3	1%	1
3001-5000	22	14.2	14%	15
5001-7500	31	20	20%	35
7501-10000	39	25.1	25%	60
10001-1500	27	17.5	18%	78
15001-20000	17	11	11%	89
20001-25000	5	3.2	3%	92
25001-35000	9	5.8	6%	98
over 35,000	3	1.9	2%	100
Total	155	100	100	

Respondent's household's expenditure on sanitation in proportion to total expenditure: The mean total expenditure for the sampled households was found to be Ksh. 12,398 with a standard deviation of 7,533. The mode and median total expenditures were Ksh. 9,250 and Ksh. 10,530 respectively. The average monthly expenditure on latrine use (only 80 respondents gave response to this question) was Kshs. 173 with a standard deviation of 199.8. The mode and median expenditure on sanitation were Kshs 100 (i.e monthly subscription fee for a public toilet per household). The ratio of mean sanitation expenditure to the total expenditure was found to be 173: 12,398 which is equivalent to 1.4%.

Table 7: Respondent's total household's expenditure

Households total expenditure (N=155)	Statistical value
Mean total expenditure (Kshs.)	12,398
Standard deviation	7,533
Mode (Kshs.)	9,250
Median (Kshs.)	10,530

Table 8: Respondent's household's expenditure on latrine/ toilet use

What is the household's monthly expenditure on latrine access
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Kshs (x)	No of respondents(f)	Percent	Valid Percent	Total (x*.f)	(x -x*)^2
50	6	4	8	300	15,160
100	48	31	60	4,800	5,347
150	13	8	16	1,950	535
200	4	3	5	800	722
300	2	1	3	600	16,097
400	1	1	1	400	51,472
500	1	1	1	500	106,847
600	3	2	4	1,800	182,222
1,200	1	1	1	1,200	1,054,472
1,500	1	1	1	1,500	1,760,597
Total	80	52	100	13,850	3,193,473
Missing	75	48			
Total	155	100	Mean (x*)	173	
			SD	199.8	
			Mode	100	
			Median	100	

Household's status of residence: 96% of the respondents (149) indicated that their households were renters while only 2% lived in "rent-free dwellings". Another one percent of the respondent's households were squatters. The status of residence determines the responsibility of sanitation development since house owners are mainly responsible for development of sanitation facilities.

Table 9: Respondent's household status of residence

Parameter	Residence status of households	No. of re-spondents	Percentage
Residence type (N=155)	Rented	149	96%
	Privately owned	3	2%
	Squatter	3	1%
	Others	1	1%
	Total	155	100%

Household's access to sanitation

Sanitation access level in the study area

Table 10 summarizes household's access to sanitation in the study area. Of the 155 sampled households, 77 respondents, representing about 50% of the respondents indicated that they had an access to a sanitation facility (toilet or a latrine) within their dwelling, while the other 78 respondents (50%) didn't have access to a sanitation facility within their dwelling.

Table 10: Access to sanitation facility

Parameter	Answer to question on sanitation access	Number of respondents	Percentage
Sanitation facility access (N=155)	No	78	50%
	Yes	77	50%
	Total	155	100%

The study found out those who didn't have access to a sanitation facility at the household dwelling either used a public toilet, shared neighbour's toilet or used plastic bag/ bucket. Public toilets were the most commonly used sanitation facilities at 45%, while 6 percent either shared from neighbours or used plastic bags as shown in table 11.

Table 11: Access to different sanitation options

Parameter	Description	Number of respondents	Percentage
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Access to sanitation options (N=155)	Household/ shared toilet/ latrine	77	50%
	Public toilet	71	45%
	Neighbour toilet	6	4%
	Plastic bag	1	1%
	Total	155	100%

On the reason for not having a sanitation facility, 85% of the respondents without a sanitation facility reported to have rented a house without a toilet while 15% mentioned other reasons such as lack of space for construction or sanitation being not a priority, as shown in table 12.

Table 12: Reason for not having a toilet/ sanitation facility

Reason for not having a toilet (N=78)	No. of responses	Percentage
Rented house with no sanitation facility	66	85%
Others (no space for construction, not a priority and others)	12	15%
Total	78	100%

Sanitation access by type and disposal type

Table 13 shows the sanitation access by sanitation type and waste disposal method. Pour-flush toilets were reported as the most common type of sanitation facilities found in the four wards and used by 37% of the respondents followed by water closet/ flush toilets at 7%. Overall, 44% of respondents can be categorized to have an access to improved sanitation facilities.

On sewerage disposal, over 40% of the respondents indicated to be connected to city sewer network while 4% were discharging into drainage channels or creeks. About 6% of the respondents were using on-site sanitation disposal systems such as septic tanks and pit latrines.

Table 13: Sanitation type and waste disposal type

Category	Description	Frequency	Percentage
Sanitation facility type (N=155)	No access	78	50%
	Pour Flush toilet	57	37%
	Water Closet/ flush Toilet	11	7%
	Pit latrine with slab/stone walls	6	4%
	Others	2	1%
	Traditional latrine/ timber slab and iron sheet walls	1	1%
	Total	155	100%
Waste disposal type (N=155)	No access	78	50%
	Sewer system	61	40%
	Drainage/ river	6	4%
	Septic tank	5	3%
	Pit latrine	5	3%
	Total	155	100%

Sanitation access by the number of households sharing

Table 14 shows the households sharing sanitation facilities. The study found out that 83% of the respondent's households with access to a sanitation facilities at household dwelling shared their sanitation facilities with other households. The other 17% of the respondent households were not sharing their facilities. On the number of families sharing sanitation facilities, 60 (78%) of the respondents reported that their facilities were shared by 5 and more households (about 30 persons) while only 4 (5%) of the facilities were shared by 2-4 families.

Table 14: Households sharing sanitation facilities

Parameter	Description	Number of respondents	Percentage
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If the facilities are shared (N=77)	Yes	64	83%
	No	13	17%
	Total responses	77	100%
No. of families sharing the facility (N=77)	More than 7 families	50	65%
	5-7 families	10	13%
	2-4 families	4	5%
	Not sharing	13	17%
	Total valid responses	77	100%

Sanitation access by the distance from the household's dwelling

Table 15 shows the distance of the sanitation facility from the household dwelling. 58 respondents representing 10% of the respondents had their sanitation facilities within their dwelling while another 37% had their sanitation facilities within 30m from their dwelling. Only 3% of the respondents had their sanitation facilities located more than 50m from the household dwellings.

Table 15: Distance of the sanitation facility from the household's dwelling

Distance from sanitation facility (N=155)	Number of respondents	Percentage
No access	78	50%
Within 30 m	58	37%
Inside the house	15	10%
More than 50 m	3	2%
100 m from the household	1	1%
Total	155	100%

Sanitation access level by ward or area

Table 16 shows the comparison between the shelter/settlement type and access to sanitation facility. Ngei ward was found to have the highest access to sanitation facilities at 93% followed by Mlango Kubwa (46%) and Mabatini (33%) with hospital ward having the lowest sanitation access at only 8%. Sanitation access was mainly influenced by the shelter/ settlement type, with areas having more permanent/ planned housing registering a better sanitation access; for instance, Ngei ward with 76% of dwellings as apartments/ flats/ multi-dwelling units had the highest sanitation access compared to hospital ward whose highest proportion (88%) of household's dwellings were Iron sheets/ informal settlement, had the lowest sanitation access as summarized in the table 16 below:

Table 16: Sanitation access and shelter type by ward/ area

Location (Ward Name)	Sanitation access	Shelter type (N=155)		
		Stonewalled single unit with own compound	Iron sheets/ informal settlement	Apartments/ flats/ multi-dwelling units
Ngei	93%	14%	10%	76%
Mlango Kubwa	46%	6%	87%	7%
Mabatini	33%	19%	75%	6%
Hospital	8%	12%	88%	0%

Ownership/ financing of sanitation facilities

Table 17 shows how sanitation how household sanitation facilities are financed. The study found out that household sanitation facilities are developed and financed by landlords, as reported by over 98% of the respondents having access to household sanitation, while only 1% were self-financed. External support from financiers such as NGO was only 1%. This points at the limited institutional support in financing household's sanitation infrastructure. Nevertheless, most of the public sanitation facilities were found to have been financed by donors, county government or the central government through the ministry of devolution.

Table 17: Financiers/ ownership of household's sanitation facilities

Facility financed by (N=77)	Number of respondents	Percentage
Landlord	75	98%
Self	1	1 %
NGO	1	1 %
Total	77	100%

Level of satisfaction with sanitation access

Table 18 and 19 summarizes the household's level of satisfaction with their sanitation facilities. All the respondents mentioned that they were somehow dissatisfied with their current sanitation facilities. 55 of the respondents (35%) cited the use of the facility by many people as the main reason for being dissatisfied with the sanitation facilities. This was mainly attributed to privacy, convenience and inability to keep the facility clean. The second reason was the distance of the facility from the household dwelling at 20% (32 respondents) followed by non-availability of water at the facility at 20% (31 respondents) and facility not secure 12% (7 respondents). The least cited reason for dissatisfaction with the sanitation facility was the design/ technology mentioned by 2 respondents (1%).

Table 18: Level of satisfaction with the sanitation facility

Reasons for not being satisfied with the facility (N=155)	No of respondents	Percent	Valid Percent	Cumulative Percent
Facility used by many people	55	35%	35%	35%
Facility very far away	32	20%	20%	55%
Non-availability of water	31	20%	20%	75%
Facility not secure	12	7%	7%	82%
Facility not well constructed/ designed	2	1%	1%	83%
Combination of factors (as show in table 19)	26	17%	17%	100%
Total	155	100	100	

26 of the respondents mentioned more than one reason why they were dissatisfied with the facilities. The highest mentioned combination was that of the facility being used by many people and facility not well constructed/ designed mentioned by 5 respondents followed by facility used by many people and facility very far away (4 respondents), facility used by many people and facility not secure (3 respondents) and facility used by many people, facility not well constructed/ designed and non-availability of water (2). Other combinations were only mentioned once as show in table 19.

Table 19: Level of satisfaction with the sanitation facility (combination of factors)

Reasons for not being satisfied with the facility (N=155)	No of respondents
Facility used by many people Facility not well constructed/ designed	5
Facility used by many people, Facility very far away	4
Facility used by many people, Facility not secure	3
Facility used by many people, Facility not well constructed/ designed Non-availability of Water	2
Facility used by many people, Non-availability of Water, Facility very far away	1
Facility used by many people,	1

Non-availability of Water	
Facility used by many people, Non-availability of Water Facility very far away	1
Facility used by many people, Facility not secure, Facility very far away	1
Facility used by many people, Non-availability of Water	1
Non-availability of Water Facility very far away	1
Facility not secure, Facility very far away	1
Facility not well constructed/ designed Facility used by many people	1
Facility not well constructed/ designed Non-availability of Water	1
Total	26

Insecurity when using the toilets/ latrines

Insecurity threats during the use of a sanitation facility, although ranked 4th for dissatisfaction with the facilities, had about 34% of the respondents reporting that they felt insecure when using the facility. The reasons for insecurity were: fear of darkness at the facility (37%); fear of muggers (23%); distance from the dwelling (19%); fear of falling due to weak structure (17%) and fear of rapist at 4%. Table 20 shows the respondents who felt insecure while using the facilities and the reasons for feeling insecure.

Table 20: Reasons for feeling insecure while using a sanitation facility

Parameter	Description	No. of respondents	Percentage
Do you feel insecure when using a household toilet or public sanitation (N=155)	No	102	66%
	Yes	52	33%
	Did not answer	1	1%
	Total	155	100%
Reasons for feeling insecure while using the facility (N=52)	Afraid of darkness at the facility	19	37%
	Afraid of muggers	12	23%
	Distance from the dwelling	10	19%
	Fear falling inside due to weak structure	9	17%
	Afraid of rapists	2	4%
	Total	52	100%

Table 21 shows the members of the household who felt insecure, where 52 respondents participated (participants were able to mention more than one member of the household). Asked about the members of the household who felt insecure, girls were reported as the most insecure with a score of 69% (36 out of 52) followed by women at 62% (32 out of 52) and boys at 42% (22 out of 52) while men were least insecure when using the facilities, mentioned by only 12 respondents.

Table 21: Household member who felt insecure when using a sanitation facility

Members of the household who felt insecure (N=52)	Number of times mentioned	Number of respondents	Percentage of respondents
Girls	36	52	69%
women	32	52	62%
Boys	22	52	42%
Men	12	52	23%

Conditions of cleanliness of toilets/ latrines

The general conditions of most of the sanitation facilities (toilets or latrines) observed were found to be between fair to poor (87%). Most of them lacked water and hand washing facilities such as taps and sinks (85%) and over 90% lacked soap for hand washing, mostly owing to the communal ownership/ and use of the facilities. The level of hygiene was poor, making the facilities unattractive, especially for small children.

Table 22: Sanitary conditions of the toilets/ latrines

Indicator	Description	Frequency	Percentage
Condition of toilet (N=155)	Fair	82	53%
	Poor	52	34%
	Good	21	14%
	Total	155	100%
Presence of hand washing facilities (sinks, taps) (N=155)	No	131	85%
	Yes	24	15%
	Total	155	100%
Presence of soap near the hand washing sinks (sinks/ taps) N=155	No	144	93%
	Yes	11	7%
	Total	155	100%

Household's knowledge and practices on sanitation

Respondent's main environmental concern in the settlement

Solid / liquid waste pollution and poor drainage were mentioned as the main environmental concerns or priorities as cited by 60% of the respondents in the four wards. These were followed by inadequate supply of water at 22% and lack of improved sanitation at 10%. Poor planning/ housing and poor road, electricity although a major characteristic of these settlements, were less mentioned by respondents, representing 6% and 3% respectively.

Table 23: Respondent's main environmental concern/priority

Environmental concern	No. of respondents	Percentage
Solid / liquid waste pollution	46	30%
Poor drainage	46	30%
Inadequate supply of water	34	22%
Lack improved sanitation facilities at household level	16	10%
Poor planning/ housing	9	6%
Poor roads, electricity network	4	2%
Total respondents	155	100%

Respondent's understanding of sanitation- disease linkages

Table 24 shows a summary of the respondent's knowledge of the causes of diseases in relation to sanitation (respondents were to mention as many as possible without influence). Asked about their knowledge on what causes diarrhea, 93 respondents (65%) cited germs to be the cause, followed by poor hygiene with 80 (52%), dirty food with 75 (48%), dirty water with 51 (33%), dirty hands with 33 (21%), flies with 15 (10%) and open defecation mentioned by only 10 respondents (6%). The data indicates that's most of the respondents had some background knowledge on the connection between diarrhea and general hygiene and sanitation with only about 10% indicating that they didn't know what caused diarrhea, believing it's part of child's growth or its caused by other causes such as rain. Nevertheless, only 6% of the respondents cited the direct impact of faecal contamination resulting from open defecation. The respondent's understanding of sanitation and diseases linkages were a confirmation of some active public awareness and hygiene education programme, as reported by the one of the Key Informant i.e Public health officer in charge of water and sanitation.

Table 24: Respondent's knowledge of causes of diarrhea

Cause of diarrhea	No. of respondents citing	Total respondents	Percentage
Germs	93	N=155	65%
Poor hygiene	80	N=155	52%
Dirty food	75	N=155	48%
Dirty water	51	N=155	33%
Dirty hands	33	N=155	21%
Flies	15	N=155	10%
Open defecation	10	N=155	6%
Other	8	N=155	5%
Do not know	4	N=155	3%
Part of child's growth	3	N=155	2%
Rain	3	N=155	2%

Respondent's knowledge of how to stop diarrhea

Table 25 show a summary of respondent's response on their knowledge on how diarrhea can be prevented. The interview question on the respondent's knowledge on how diarrhea can be prevented had 62 (40%) of the respondents mention proper food preparation, followed by drinking clean water with 59 (38%), washing hands with water and soap by 52 respondents (34%), covering food by 44 respondents (28%) and treating water by 39 (25%). No open defecation and latrine use were however among the least mentioned at 15% and 13% respectively, an indication of a gap between knowledge of causes of diarrhea and practices to prevent diarrhea.

Table 25: Respondent's knowledge on how diarrhea can be prevented

Respondent's knowledge on how diarrhea can be prevented	No. of respondents citing	Total Respondents	Percentage
Prepare food properly (cooking, washing)	62	N=155	40%
Drink clean water	59	N=155	38%
Wash hands with water and soap/ash	52	N=155	34%
Covering food	44	N=155	28%
Treating water	39	N=155	25%
Other	28	N=155	18%
No open defecation	23	N=155	15%
Store water safely	22	N=155	14%
Latrine use	20	N=155	13%
Do not know	7	N=155	5%
Prayer	1	N=155	1%

Respondent's sanitation and hygiene practices

On household's sanitation and hygiene practices, washing hands before eating was the most mentioned as the key times when the respondent's washed their hands, as cited by 147 out of 155 respondents (95%) followed by washing hands after visiting a toilet/ latrine by 112 respondents (72%) and washing hands after eating by 100 respondents (65%). This is an indication that the majority of the respondents were aware of the significance of transmission of diseases from toilets to food through hands. Nevertheless, washing of hands before food preparation, before feeding a child and after handling baby's diapers/ faeces were less

mentioned at 21%, 18% and 10% respectively, which is an indication of possible avenues of food contamination and high incidences of diarrhea in under 5 children.

Table 26: Respondent's sanitation and hygiene practices

Handwashing practice (N=155)	No. of respondents	Total respondents	Percentage
Before eating	147	N=155	95%
After latrine use	112	N= 155	72%
After eating	100	N= 155	65%
Before food preparation	32	N= 155	21%
After handling rubbish	28	N= 155	18%
Before feeding child	28	N= 155	18%
After handling baby's diaper/feaces	15	N= 155	10%
Other	13	N= 155	8%
After handling animals	1	N= 155	1%

Handwashing with soap practices

Use of soap during handwashing was found to be practiced by 56% of the respondents while 44% of the respondents used water only for hand washing. This is an indication of knowledge and practice gap, which can hinder complete elimination of diarrhea and other water-borne diseases at household level.

Table 27: Respondent's use of soap during hand washing

Hand washing practice (N=155)	No. of respondents	Percentage
Water & Soap	87	56%
Water only	68	44%
	155	100%

Water treatment practices

The study found out that 67% of the respondent's households did not practice water treatment, albeit the unhygienic conditions where the water is obtained. Most of the water in slums is highly contaminated with faecal matter owing to lack of improved sanitation facilities and poor drainage resulting to high incidences of diarrhea, worm's infections, skin diseases and other water-borne/ water washed and water-related diseases. The data is as summarized in table 28.

Table 28: Respondent's household practices on water treatment

Do you treat water? (N=155)	No. of respondents	Percentage
No	104	67%
Yes	51	33%
	155	100%

Respondent's perception of the effects of poor sanitation access to their livelihoods.

Lack of improved sanitation facilities (poor sanitation access) was noted to have multiple effects on households. Of the 77 households who didn't have sanitation facilities at their dwelling, 35 of them (46%) indicated that it had some financial effects on the household's income as they had to pay for to get the services at a public facility, while another 23 (30%) more reported that lack of sanitation had an impact on their health through diarrhea and other water born-related diseases resulting from environmental pollution. Further, related to households livelihoods, 14% reported that lack of sanitation facility resulted in time wastage and hence loss of income owing to lack of convenience of having the facility at their dwelling. Table 29 shows a summary of the respondent's perception of the effect of poor sanitation access to their livelihoods.

Table 29: Summary of the effects of lack of a sanitation facility to households

Effects of lack sanitation on Households (N=77)	Number of respondents	Percentage
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Pay more for sanitation access	35	46%
Infected by diarrhea and other water-borne diseases.	23	30%
Wastage of time/ loss of income	11	14%
Environmental pollution	5	6%
Threat due to insecurity	3	4%
Total	77	100%

Lack of a sanitation facility at a household's dwelling also exposed different members of the household to security threats such as thefts, rape and physical harm as reported by 4% of the respondents without a toilet inside or near their dwelling.

Cost implications of lack of sanitation facility at household dwelling

Households without a sanitation facility (toilet or latrine) within their dwelling indicated to incur some cost to cater for sanitation access. Overall, sanitation access expenditure was estimated to constitute about 1.4% of the average household's expenditure (Table 7 and 8). Majority of the households without a sanitation facility indicated that they mostly used a public facility as cited by 45% of the respondents. This was done on a pay-per-use basis, as indicated by 99% of those using public toilets. On the actual household expenditure on toilet/ latrine access, 94% of the respondents using public toilets reported to have been spending Kshs. 500 and below while about 6% spend Kshs 500 and above as per the table 30 below.

Table 30: Households who paid for public sanitation

If a public sanitation facility, do you pay for use of the facility? (N=71)				
	No. of respondents	Percent	Valid Percent	Cumulative Percent
No	1	1%	1%	1%
Yes	70	99%	99%	100%
Total	71	100%	100%	

Table 31: Respondent's household's direct expenditure on public toilets

If a public sanitation facility, how much do you spend per month for sanitation? (N=70)				
Amount in Kshs.	No. of respondents	Percent	Valid Percent	Cumulative Percent
500 and below	66	94	94	94
501-1000	3	4	4	98
1001-1500	1	2	2	100
Total	70	100	100	

Respondent's perception of the relationship between poor sanitation access and incidences of diarrhea and other water-borne diseases

Lack of improved sanitation was said to contribute to incidences of diarrhea and other water-borne diseases. Table 32 gives a summary of common diseases as reported by the 155 respondents in the study area. Diarrhea scored highest as the most prevalent disease in the four wards, as mentioned 90 times (58% of respondents) followed by malaria mentioned 70 times (45%) and Cholera 65 times (42%). The sum total of all water-borne and sanitation-related diseases (diarrhea, Cholera, typhoid, amoeba and dysentery) as mentioned by respondents was 201 times with a total score of 66% of all responses.

Table 32: Summary of common diseases as reported by respondents

Prevalent Disease	No of times mentioned	Total number of respondents	Percentage
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Diarrhea	90	N=155	58%
Malaria	70	N=155	45%
Cholera	65	N=155	42%
Airborne diseases (e.g. common colds, flu etc)	25	N=155	16%
Typhoid	22	N=155	14%
Amoeba / intestinal worms	17	N=155	11%
Pneumonia	8	N=155	5%
Dysentery	7	N=155	5%

On diarrhea incidence in the four wards, at least 28% of the respondents reported an incident of diarrhea within a month before the date of the data collection. The highest percentage of those by affected were persons aged between 18-59 years at 49% followed those aged between 0-5 years and 6-17 years each at 26%.

Table 33: Diarrhea incidence rate and age brackets

Parameters	Incidences	No. of respondents	Percentage
Diarrhea incidence (N=155)	No	112	72%
	Yes	43	28%
	Total	155	100%
Age brackets (N=43)	18-59 yrs old	21	49%
	0-5 yrs old	11	26%
	6-17 yrs old	11	26%
	Total	43	100%

On diarrhea-related mortality in the area of study, at least 2 people were reported to have passed away a month before the study, one aged between 0-5 years and another 6-17 years.

Table 34: Diarrhea mortality rate and age brackets

Indicator	Description	Frequency	Percentage
Diarrhea mortality	No	153	99%
	Yes	2	1%
	Total	155	100%
Diarrhea mortality and Age brackets of those affected.	Not Applicable	153	99%
	0-5 yrs old	1	1%
	6-17 yrs old	1	1%
	Total	155	100%

Medical data evidence on the prevalence of diarrhea and sanitation-related diseases in the study area. Under 5 morbidity rate in the four wards

Medical data obtained from four medical facilities of health summing up top ten diseases in the study area for 6 months (September 2017 – March 2018), for under 5 years children indicated that Upper Respiratory Tract infection-URTI was the leading disease in all the facilities adding up to about 6,760 cases followed by diarrhea (3,017 cases) and Pneumonia with 1,039 cases. Other water and sanitation-related diseases such as skin infections, eye infections and intestinal worms were also very prevalent in the area, ranked 4th, 6th and 7th respectively. Lack of improved sanitation (together with water and proper hygiene) is arguably the second leading risk factors and contribution to morbidity for under 5 years in the study area. The data is summarized in table 35 below.

Table 35: Top 10 Diseases in Mathare Slums - Under 5 years

Type of ailment	Huruma Lions Health Centre	Mathare Police Depot	Upendo Dispensary	SHOFCO medical clinic	Total	Rank
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1	Upper Respiratory Tract infection-(URTI)	2,924	750	900	2186	6,760	1
2	Diarrhea	609	253	551	1,604	3,017	2
3	Pneumonia	0	2	258	779	1,039	3
4	Skin infections	149	119	154	407	829	4
5	Malaria	14	3	50	442	509	5
6	Eye infection	40	17	116	169	342	6
7	Intestinal worms	29	93	151	36	309	7
8	Urinary Tract infections	8	3	91	97	199	8
9	Sexually transmitted Infections	0	20	21	21	62	9
10	Violence related injuries	5	0	0	0	5	10

Source: Huruma Lions Health Centre, Mathare police depot, Upendo Dispensary, and SHOFCO medical clinic (MOH-705A- Outpatient under 5 yr. summary)

Over 5 morbidity rate in the four wards

The over 5 years medical data obtained from the four medical facilities of health summing up top ten diseases in the study area for 6 months (September 2017 – March 2018), indicated that Upper Respiratory Tract infections-URTI was the leading disease in all the facilities adding up to about 8,023 cases followed by Pneumonia (1,707 cases) and Diarrhea with 1,488 cases. Sexually transmitted infections and Urinary tract infections were significant for over 5 years both contributing a total of 2,105 cases. Lack of improved sanitation (together with water and proper hygiene) remains a major risk factor and contribution to morbidity for over 5 years in the study area. The data is as summarized in table 36 below.

Table 36: Top 10 Diseases in Mathare Slums - Over 5 years

	Type of ailment	Huruma Lions Health Centre	Mathare Police Depot	Upendo Dispensary	SHOFCO medical clinic	Total	Rank
1	Upper Respiratory Tract infection-(URTI)	4351	659	824	2,189	8,023	1
2	Pneumonia	0	13	299	1395	1,707	2
3	Diarrhea	94	145	417	832	1488	3
4	Sexually transmitted Infections	45	40	116	853	1054	4
5	Urinary Tract infections	50	46	112	843	1051	5
6	Malaria	33	21	27	648	729	6
7	Skin infections	91	135	42	367	635	7
8	Eye infection	12	12	117	185	326	8
9	Intestinal worms	34	173	12	97	316	9
10	Violence related injuries	32	6	0	154	192	10

Source: Huruma Lions Health Centre, Mathare police depot, Upendo Dispensary, and SHOFCO medical clinic (MOH-705B- Outpatient over 5 yr. summary)

5. DISCUSSIONS

Households' access to sanitation

The study established that only 50% of the households had an access to a household sanitation facility in the study area. The other population either used a public toilet (45%), neighbour's toilet (4 %) or plastic bag/ bucket (1%). Most of the household's sanitation facilities are shared as reported by 83% of the respondents with household sanitation access, with only 17% of the household's having a private sanitation facility. Multiple households shared a single facility, with 78% of the households sharing with over 5 other households.

Pour-flush toilets were the most commonly sanitation technological option used in the study area, as reported by over 37% of the respondents. Majority of the sanitation facilities available can be classified as improved (44%), with another 6% composed of traditional pit latrines and others. On sewer connection, 40% of the respondents had connections to city sewer network while 4% were discharging into drainage channels or creeks. Another 6% used onsite sanitation disposal system such as septic tanks and pit latrines.

On distance of sanitation facility to the household's dwelling, 10% of the respondents had their sanitation facilities within their dwelling while another 37% had their sanitation facilities within 30m from their dwelling. Only 3% of the respondents had their sanitation facilities located more than 50m from the household dwellings. Sanitation access was found to differ from ward to another depending on the settlement/shelter type. The highest sanitation coverage was found in areas with more permanent housing such as Ngei (93%) and Mlango Kubwa (46%) while the coverage was lowest in Mabatini (33%) and Hospital ward (8%), where most of the houses had walls types/ roof types made of were iron sheets informally planned and constructed.

The overall approval rate (satisfaction) of the sanitation facilities by households was low, the reasons being the use of the facility by many people, hence lack of privacy, convenience and inability to keep the facilities clean. The second in the rank for disapproval was the distance of the facility from household's dwelling which exposed the household's members to insecurity at night. Other reasons were the non-availability of water at the facility, the design/ technology and insecurity while using the facilities.

Financing of sanitation facilities

The study found out that 98% of the households were renters hence the landlords were the main financiers of the sanitation facilities. The financing role of individual households was minimal, while the private sector and government roles in financing household sanitation was only 1%.

Role of Institutions and legal framework in the provision of sanitation services

Sanitation development was found to be directly linked to shelter development in Mathare sub-county, which is influenced by the institutional support and control, through approval of plans, designs and construction standards. Ngei ward, like the neighbouring upgraded Mathare 4A, was found to have a strong institutional support and control from the county government, where all new developments were approved before development. This resulted in a better organized and properly planned settlement incorporating basic public health amenities (such as toilets). Mabatini, Hospital and Mlango Kubwa wards, on the other hand, were found to have had a weak institutional and policy control (by national and county government), except for the provincial administration (office of the president) who was found to have grassroots representation. Shelter development, in this case, consists of informal, unregistered and unregulated housing and service providers, who are mainly for profit, and often avoid essential services such as sewage and wastewater management (Otiso, 2000), (Otiso, 2003)[38]. The informal nature of development was therefore found to be a hindrance in enforcing public health standards in the study area.

Household's knowledge and practices on sanitation

Sanitation ranked fourth in terms of the respondents priority concerns after solid waste, drainage and liquid waste and water supply. The research found out that majority of the households had some background knowledge on the connection between diarrhea and general hygiene and sanitation with only about 10% indicating that they didn't know what caused diarrhea. Nevertheless, only 6% of the respondents cited open defecation which is the main cause of faecal contamination into water bodies and the environment. On how to prevent diarrhea and other sanitation-related diseases, "No open defecation" and "latrine use" were among the least mentioned at 15% and 13% respectively, an indication of knowledge and practice gaps on the causes of diarrhea and practices to prevent it.

On practices sanitation and hygiene practices such as handwashing with soap and water treatment, handwashing before eating, after defecation and after meals were the most common practices as mentioned by 95%, 72% and 65% of the respondents. On water treatment practices, only about 33% of the respondents confirmed treating their water for domestic purpose, albeit the poor sanitary conditions in the area. Respondent's perception of the effects of lack/poor of sanitation on their livelihoods

Lack of improved sanitation and proper hygiene was perceived to have multiple effects on household's livelihoods. Economically, the majority of the households (94%) without sanitation facilities in their dwelling indicated to be spending

about Ksh 500, equivalent to about 1% of their income to pay for sanitation at a public toilet on a pay-per-use basis.

On health, both the data from the respondents at the household level and medical data from the four main health facilities indicated diarrhea and other sanitation-related diseases to be the second leading risk factors and contribution to morbidity for under 5 years, and the third leading risk factors and contribution to morbidity for over 5 years in the study area. Further, households were found to spend at least 5% of their income per month to access medical services, with the majority of the ailments resulting from lack of improved sanitation, water and hygiene.

6. CONCLUSIONS

The purpose of the study was to assess sanitation and its implication on households' livelihoods in Mathare sub-county, Nairobi County, focusing on four wards namely: Mabatini, Ngei, Hospital and Mlango Kubwa wards which cover the greater Mathare slums. The study sought to establish current sanitation access in Mathare slums, knowledge and practices gaps in Mathare slums and to establish the effect sanitation access on household's livelihood in Mathare slums. It was established through the literature review that sanitation access impacts on household's livelihoods and through analysis of data from the field.

The study found out that sanitation coverage in the informal settlements is still low despite the national governments and county government's efforts to improve sanitation access in these areas. The study established that only 50% of the households had access to a sanitation facility (47% to an improved/limited sanitation access) at the household level, which are, however, shared by multiple households. Households without toilets at household level primarily used public toilets, which were found to be accessible during the day time, forcing the households to use buckets, plastic bags or practice open defecation. Development of public sanitation is, therefore, a temporal solution to sanitation access for households and therefore, not considered as improved sanitation (World Bank, 2013) [21].

Analysed data obtained from households and medical records from the four main health facilities in the area confirmed that diarrhea and other sanitation and hygiene-related diseases were the second leading contributor to morbidity rate for under five years and the leading third cause of morbidity for over five years in the study area. Frequent hospitalization impacted negatively to household's income through reduced productivity, increased expenditure due to medication, reduced asset base and saving due to a limited choice between purchasing food, medicine, paying for sanitation access and purchasing of fixed assets. Sanitation access, was therefore, found to impact directly on household's livelihoods through direct costs to pay for sanitation access, cost of medication and reduced productivity due to sickness.

Recommendations

The following recommendations are made based on the findings from this research, targeting policymakers, and development partners and slums residents:

1. Controlled development is one of the most effective ways of increasing sanitation coverage in the urban informal settlements. All new buildings in the area should be approved and be constructed in strict adherence to urban public health standards. These measures would ensure that all buildings, including temporary structures, have a sanitation facility, to serve its occupants. The relevant bodies such as the County Government should, therefore, increase institutional support through enhanced capacity on the ground (in terms of skills and numbers) to ensure full compliance.
2. Landlords and landowners are solely responsible for the construction of sanitation facilities in the area. Innovative and attractive strategies targeting landlords should, therefore, be put in place to enhance sanitation and hygiene services in the urban informal settlements. Such strategies include development of technologies which converts toilet waste (faecal sludge) to organic fertilizers eg. Sanergy model, (Mark O'keefe, 2015) [39], energy from charcoal briquettes (Sanivation technology) and biogas converters or bio-digesters. These can be financed through private-private partnership, or through the provision of micro-credits targeting the landlords and developers.
3. Sanitation-related diseases can significantly be reduced through improved personal hygiene, such as the practice of handwashing with soap at key times, elimination of open defecation and water treatment. Public health officers, NGOs and community leaders should, therefore, develop and implement custom-made urban community-led total sanitation (Urban CLTS) programmes to tackle open defecation and enhance personal hygiene awareness at household level in the four wards.
4. Sanitation development should be linked to household's livelihoods. This includes adoption of strategies such as: training of artisans and household members on appropriate technologies; development of sanitation systems with added values such as biogas, charcoal briquettes, which can be sold cheaply to slums dwellers; and development of public sanitation facilities with additional services such as bathrooms, water kiosks, and retail shops for household goods. Organized community groups such as youth and women groups should be involved in the operation and management of public toilets, to enable them to generate income.
5. Slum-upgrading programmes should be up-scaled, targeting the areas with poor sanitation access such as Hospital ward and Mabatini wards. "State, voluntary and private sector model"[38] have shown success in

the neighbouring settlements such as Mathare 4A and Kibera upgrading programme. In Mathare 4A, the implemented programme significantly improved the living conditions for over 30,000 persons, through construction of 8000 rooms, business stalls, kindergartens, installation of streetlights, improved road networks, reticulation of water and sewerage system, construction of one "wet-core" (shower-toilet-washing slab) per 10 households and a water drainage system (Otiso, 2003)[38].

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8. REFERENCES

- [1] UN. (2016). The Sustainable Development Goals Report. New York: UN.
- [2] GOK/MOH. (2016). Kenya Environmental Sanitation and Hygiene Policy, 2016-2013. Nairobi: GOK.
- [3] Hussain Namara Regassa, and Deeptha Wijerathna (2002). Water, Health and Poverty Linkages: Conceptual Framework and Empirical Evidence. National Workshop on Water, Health and Poverty Linkages in Sri-lanka. Colombo Resource Center and International Water Management Institute (IWM).
- [4] WHO. (2013, April). Diarrhoeal disease Fact sheet N°330. Retrieved December 1, 2015, from WHO: <http://www.who.int/mediacentre/factsheets/fs330/en/>
- [5] Prüss-Üstün, Bos R, Gore F, Bartram J (2008). Safer water, better health: costs, benefits and sustainability of interventions to protect and promote health. Geneva: World Health Organization.
- [6] GOK/MOH. (2007). National Environmental Sanitation and Hygiene Policy. Nairobi: GOK.
- [7] Jacob, Professor Leigh Anderson, Professor Susan Bolton (2010, December 10). The Public Health Benefits of Sanitation Interventions. Retrieved December 1, 2015, from Evans School Policy Analysis and Research (EPAR): https://evans.uw.edu/sites/default/files/public/Evans_UW_Request_104_Public_Health_Benefits_of_Sanitation_November-10-2010_ft.pdf
- [8] Esrey S.A, J.B. Potash, L. Roberts, & C. Shiff (1991). Effects of improved water supply and sanitation on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis, and trachoma. Bulletin of the World Health Organization, pp. 69 (5): 609-621.
- [9] OECD. (2011). Benefits of Investing in Water and Sanitation: An OECD Perspective (<http://dx.doi.org/10.1787/9789264100817-en>). OECD.
- [10] ICSU, I. (. (2015). Review of Targets for the Sustainable Development Goals: The Science Perspective. Paris: International Council for Science (ICSU).
- [11] UNICEF/ WHO. (2015, June). WHO/ UNICEF Joint monitoring programme. Documents. Retrieved December 2015, 2015, from JMP/WHO/Unicef Joint Monitoring programme (JMP) for Water Supply and Sanitation: [http://www.wssinfo.org/documents/?tx_displaycontroller\[type\]=country_files](http://www.wssinfo.org/documents/?tx_displaycontroller[type]=country_files)
- [12] WHO/UNICEF. (2017). Progress on drinking water, sanitation and hygiene: 2017 update and SDG baselines. Geneva, World Health Organization and the United Nations Children's Fund (UNICEF), 2017. Licence: CC BY-NC-SA 3.0 IGO. Retrieved October 19, 2015, from <http://www.who.int/mediacentre/news/releases/2017/launch-version-report-jmp-water-sanitation-hygiene.pdf>
- [13] Wasonga, Charles Omondi Olang'o and Felix Kioli (2014). Improving Households Knowledge and Attitude on Water, Sanitation, and Hygiene Practices through School Health Programme in Nyakach, Kisumu County in Western Kenya. Journal of Anthropology, 1.
- [14] APHRC. (2014). Population and Health Dynamics in Nairobi's Informal Settlements: Report of the Nairobi Cross-sectional Slums Survey (NCSS) 2012. Nairobi: APHRC.
- [15] UN-Habitat. (2006). Nairobi Urban Sector Profile. Nairobi: UN-Habitat.
- [16] Wwap. (2015). The United Nations World Water Development Report: Water for a Sustainable World. Paris: UNESCO.
- [17] UN-Habitat. (2008). The State of African Cities 2008: A framework for addressing urban challenges in Africa. Nairobi: UN Habitat.
- [18] IRC, I. W. (2007). Enhancing Livelihoods through Sanitation. Delft, The Netherlands: IRC.
- [19] Nelson Ekane, Nina Weitz, Björn Nykvist, Petter Nordqvist and Stacey Noel. (2016). Comparative assessment of sanitation and hygiene policies and institutional frameworks in Rwanda, Uganda and Tanzania. 115 23 Stockholm; Stockholm Environment Institute. World Bank. (2013). World Development Indicators 2013. doi: 10.1596/978-0-8213-9824-1. License: Creative Commons Attribution CC BY 3.0. Washington, DC.
- [20] Nelson Ekane, Björn Nykvist, Marianne Kjellén, Stacey Noel and Nina Weitz. (2014). Multi-level sanitation governance: Understanding and overcoming the challenges in the sanitation sector in Sub-Saharan Africa. Stockholm Environment Institute.
- [21] World Bank. (2013). World Development Indicators 2013. doi: 10.1596/978-0-8213-9824-1. License: Creative Commons Attribution CC BY 3.0. Washington, DC.
- [22] APHRC. (2014). Population and Health Dynamics in Nairobi's Informal Settlements: Report of the Nairobi Cross-sectional Slums Survey (NCSS) 2012. Nairobi: APHRC.
- [23] NCWSC/AWSB. (2009). Strategic Guidelines for Improving Water and Sanitation Services in Nairobi's Informal Settlements. Nairobi.
- [24] MUST, S. U.-B. (2011). Mathare Valley Collaborative - Upgrading Plan. Nairobi, Kenya.
- [25] Abdulla, Ian MacAuslan, Lilly Schofield. (2011). International Conference: Institute of Development Studies, UK. Towards Sustainable Vulnerability Reduction for Kenya's Ultra-Poor living in Urban Slums (p. 2). UK: Institute of Development Studies, UK.
- [26] Reba, P. (2003). Sectoral trends in the water sector (Technology, Policy and Poverty) in South Asia. South Asia Conference on Technologies for Poverty Reduction, (p. 1). New Delhi.
- [27] Jensen, J. (2009). Understanding the links between Water, Livelihoods and Poverty in Kenya (Master's Thesis). UNIVERSITY OF FLORIDA.
- [28] Practical Action. (2005). Livelihoods and Gender in Sanitation, Hygiene and Water services among the urban poor.
- [29] Joanna P. & Kate M. (2008). A literature review of the non-health impacts of Sanitation.
- [30] SuSanA. (2009). Integrating a gender perspective in sustainable sanitation. Sustainable Sanitation Alliance. SuSanA - fact sheet, version 1.1 (01/2009) - first draft.
- [31] Alan Nicol, O. (1999). A Poverty-Reduction Approach to Water, Sanitation and Hygiene Programmes-A WaterAid Briefing Paper.
- [32] Sullivan J.R. Meigh, A.M. Giacomello, T. Fediw, P. Lawrence, M. Samad, S. Mlote, C. Hutton, J.A. Allan, R.E. Schulze, D.J.M. Dlamini, W. Cosgrove, J. Delli Priscoli, P. Gleick, I. Smout, J. Cobbing, R. Calow, C. Hunt, A. Hussain, M.C. Acreman, J. Kin (2003). The Water Poverty Index: Development and application at the community scale. Retrieved 12 21, 2015, from Natural Resources Forum 27 (2003) 189 - 199: ftp://ftp.fao.org/agl/emailconf/wfe2005/narf_054.pdf
- [33] Batteson, Kay Davey and Rod Shaw (1998). Guidance manual on water supply and sanitation programmes. LSHTM/WEDC.
- [34] Kaiko, S. M. (2009). A Knowledge, Attitude and Practices (KAP) study of Buntangwa Clinic Catchment area in Mansa, Zambia regarding Water, Sani-

- tation and Hygiene Education. Masters thesis, University of Zambia.
- [35] Curtis V, Lisa O. Danquah and Robert V. Aunger (2009). Planned, motivated and habitual hygiene behaviour: an eleven country review. HEALTH EDUCATION RESEARCH, Vol.24 no.4 2009, Pages 655–673.
- [36] KNBS/SID. (2013). Exploring Kenya's Inequality: Pulling Apart or Pooling Together? Nairobi, Kenya: Ascent Limited.
- [37] Miller and Brewer. (2003). A-Z of Social Research. London: SAGE Publication Ltd. London: SAGE Publication Ltd.
- [38] Otiso. (2003). State, voluntary and private sector partnerships for slum upgrading and basic service delivery in Nairobi City, Kenya. Elsevier Science Ltd, 20.
- [39] Mark O'keefe, C. L. (2015, October). Opportunities and limits to market-driven sanitation services: evidence from urban informal settlements in East Africa. International Institute for Environment and Development (IIED), 432.

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