ASSESSMENT OF WATER, SANITATION AND HYGIENE PRACTICES ON DIARRHOEA AMONG UNDER-FIVE CHILDREN IN TEMEKE MUNICIPALITY, DAR ES SALAAM - TANZANIA

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN PROJECT MANAGEMENT AND EVALUATION OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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EXTENDED ABSTRACT

Water, sanitation and hygiene are essential determinants of both physical and mental human health and acts as the prerequisites for human development. For decades water, sanitation and hygiene have been treated as a single sector regardless of their impacts on human health. This study investigated WASH practices and associated infections among under-five children in selected wards of Temeke Municipality in Dar es Salaam region. The study was cross-sectional and involved 220 respondents randomly selected from three wards namely Azimio, Mtoni and Tandika. The study employed a mixed method approach, whereby both quantitative and qualitative data were obtained from the household survey and key informant (KI) interview. Quantitative data which were collected from household interviews with mothers and caregivers were analysed with the aid of IBM-Statistics SPSS v.20. The findings show that, 40% of all the respondents depend on public tap/ standpipe as their major sources of water. The findings revealed further that, the majority (99.6%) of the respondents were aware about the importance of washing hands; however, only 22.6% wash their hands with soap before meals and 45.2% use soap to wash hands after meals. The overall perception towards hand washing behaviour varied among the respondents; the majority (71.7%) reported to have been washing their hands. Others (17.8%) suggested that hand washing is hygienic, and 16.5% said it is a primary preventive measure against communicable diseases. Furthermore, findings in the present study on personal hygiene activities revealed that 79.1%, 43.4% and 35.6% of all the respondents cited bathing, wearing clothes (washing), and tooth brushing as leading. On the part of proper utilization of latrine, majority (60.8%) reported to have been washing their hands after visiting the toilet saying that it is a preventive measure against transmission of diseases, while 46.5% said they washed their hands just to keep them clean. Moreover, the study found that 9.1% of all the households have latrines that can be accessed within their plot. The study revealed further that, 96.5% of all the

households in a range of 6-10 households share latrine facilities, which are located near their respective compounds. The most common type of latrine available in the study area was pour flush without water seal linked to pit (57.3%) in Tandika, 65.3% in Mtoni, and 36.3% in Azimio. The other type was traditional pit latrines, 47.6% of which are found in Azimio, 13.3% in Mtoni, and 1.3% in Tandika. In addition, only 26%of all the latrines available were clean and 6% had water available inside the facility. As for hand washing facilities, 97.4% of the respondents reported to use a bowl for hand washing and only 0.9% had tap connected to water distribution. About 1.7% reported to have facilities available inside the house right next to the latrine, 0.9% reported to have facilities outside the house within 10 metres and only 1.3% reported to have soap available at the facility.

The respondents reported that, of all the widely known WASH related infection in the areas, diarrhoea was the leading accounting for 10% followed by cholera accounting for 7.8% of all other infections. Overall, the most vulnerable group to these infections was the under-five children accounting for 10.4% of the population. Moreover, 32.5%, 22.7%, and 17.3% of the respondents from Azimio, Mtoni and Tandika respectively suggested self-cleanliness as among the preventive measures against known water-borne diseases. Other measures were food safety from preparation to the actual eating as suggested by 32.5% from Azimio, 14.7% from Mtoni, and 6.7% from Tandika. Hand washing before meals was significantly associated with respondents' contracting of diarrhoea ($p \leq 0.05$). Generally, it can be concluded that water is still a problem in the informal settlements. Sanitary conditions and hygienic measures are even worse and these can be attributed to socio-economic factors such as income levels, education status, and place of residence. Factors such as hand washing behaviours during critical times, water treatment measures, and education levels were positively associated with diarrhoea incidences among the under-five. The study recommends that, both infrastructural improvement and education

provision should be employed in these areas with the emphasis in awareness creation regarding public health and the importance of each practice. Both sanitation and hygiene should be dealt with separately as they both impact human health at large. Projects should be implemented based on the needs of the areas such as urban slums, informal settlements, and special groups such as children, elders, and women.

DECLARATION

I, Hafidh Swaib Munissi do hereby declare to the senate of Sokoine University of Agriculture that this dissertation is my own original work done within a period of registration.

…… ……

Hafidh S. Munissi Date

(MA in Project Management and Evaluation Candidate)

The above declaration is confirmed by,

…… ……

Dr. Jilisa. K. Mwalilino Date

(Supervisor)

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DEDICATION

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LIST OF ABBREVIATIONS AND ACRONYMS

WASH	Water, Sanitation and Hygiene
SDG	Sustainable Development Goals
WHO	World Health Organization
UNICEF	United Nation Children Fund
UN	United Nations
NIMR	National Institute of Medical Research
MoHCDGEC	Ministry of Health, Community Development, Gender, Elderly and Children
UCLAS	University College of Lands and Architectural Studies
UWSA	Urban Water and Sewer Authorities
DAWASA	Dar es Salaam Water supply and Sanitation Authority
DAWASCO	Dar es Salaam Water and Sewerage Corporation
TDV	Tanzania Development Vision
FYDP II	Second Five Year Development Plan
TAWASANET	Tanzania Water and Sanitation Network
SAWA	Sanitation and Water for All
DWSSP	Dar es Salaam Water Supply and Sanitation Project
WSP	Water Sector Programme
NSGRP	National Strategy for Growth and Reduction of Poverty
TF	Typhoid Fever
SPSS	Statistical Package for Social Sciences
TDHS - MIS	Tanzania Demographic and Health Survey and Malaria Indicator Survey
JMP	Joint Monitoring Programme
MEST	Ministry of Education, Science and Technology

NSC	National Sanitation Campaign
NGO	Non-Government Organization
TZS	Tanzania Shillings
TDHS	Tanzania Demographic and Health Survey
MDG	Millennium Development Goals
GDP	Gross Domestic Product
KI	Key Informant
MoH	Ministry of Health
NBS	National Bureau of Statistics

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Water, Sanitation and Hygiene are collectively called WASH and each is a separate field though they are interdependent in nature. The survival and development of a child highly depends on the availability of clean water, improved sanitation facilities and good hygiene practices (Darvesh *et al.,* 2017). Sanitation, as used in this study, refers to the provision of facilities and services for the safe management of human excreta from the toilet to containment and storage and treatment on-site or conveyance (transportation), treatment and eventual safe end use or disposal including also safe management of solid and animal wastes (Kasala *et al.,* 2016; WHO, 2019). Globally, in developing countries, the target for sanitation as stipulated in the Sustainable Development Goals (SDGs) of the agenda 2030 by the United Nations member states have been missed by an estimate of 700 million people. About 82% and 51% of the global urban population and rural population respectively use improved sanitation facilities. In rural areas, seven out of ten people are estimated to lack improved sanitation facilities, and nine out of ten people still practicing open defecation (WHO, 2018). As reported by (WHO and UNICEF, 2015), about 2.4 billion people lacked improved sanitation facilities and an estimate of 663 million people globally still use unimproved drinking water sources, including unprotected wells and springs and surface water. Nearly half of the population with unimproved drinking water sources live in sub-Saharan Africa and approximately one fifth live in Southern Asia (WHO and UNICEF, 2019).

As reported by (UNICEF, 2018), in Tanzania only 56% of waters sources are improved with rural areas being the most disadvantaged. It is suggested that improved WASH facilities during childbirth has a significant impact on maternal and child survival. Reports

provided by World Health Organization (WHO) (2014) (cited by Mshida *et al.,* 2017; Kefeni and Yallew, 2018), revealed that lack of improved sanitation is directly related to the eruption of water-related diseases such as cholera, diarrhoea, and others. WASH-related diseases as used in this study are those diseases that are transmitted through direct drinking of water contaminated with pathogenic microorganisms, unsanitary environments, and poor hygiene practices (Forstinus *et al.,* 2015). Faeces are the principal source of bacteria, viruses, and parasites that cause diarrheal as well as many other infectious diseases. Sick people shed many more pathogens in their faeces than healthy people (WHO and UNICEF, 2019).

Diarrhoea is among the leading cause of child mortality in areas prone to shortages of services such as water, health and in some cases income poverty and low education levels particularly in developing countries (Kumi-Kyereme and Amo-Adjei, 2016). According to Fuentes *et al.* (2006, cited in Zeleke and Alemu, 2014), “diarrheal is more of a symptom than a disease, as it's a reflection of gastrointestinal infections and other related diseases such as typhoid, cholera, etc.” Typhoid Fever (TF) is both a waterborne and food-borne disease, hence poor access to safe water, sanitation and hygiene infrastructures are the major risk factors of typhoid fever (Chipwaza *et al.,* 2015). Cholera is water related disease caused by poor waste management and drainage systems, use of surface waters, which are often contaminated with faecal materials (Forstinus *et al.,* 2015), which encourages the breeding of insects and other forms of vectors within residential areas contributing to the increasing prevalence of the disease (Holmes *et al.,* 2016).

Lack of safe sanitation systems, inadequate management of faecal wastes from communities or health care facilities contribute to the emergence and spread of antimicrobial resistance by increasing the risk of infectious diseases (Korzeniewska *et al.,*

2013; Varela *et al.,* 2013). Typhoid fever and cholera, which are caused by domestic use of water extracted from wetlands are regarded as life-threatening infections in Tanzania (Boillat-Blanco *et al.,* 2018; Anthonj *et al.,* 2019; Buguzi, 2019). Cholera cases have also been reported as a contributing factor for under-five mortality whereby 90% of these deaths are attributed to poor water, sanitation and hygiene conditions (NIMR, 2016). WHO and UNICEF (2015) reports revealed that, around 16% of the Tanzania population in both rural and urban areas have access to improved toilets suggesting that more than 80% still use pit latrines majority of which are in deplorable conditions.

Furthermore, Tanzania has the third largest population under the risk of malaria in Africa and over 90% of the population live in areas where malaria is endemic (MoHCDGEC *et al.,* 2018). The health burden due to poor sanitation and hygiene in cities like Dar es Salaam, Arusha and others in Tanzania is still significant with diarrhoea as the leading affecting 15% of children under-five years of age, and resulting in 9% of all mortality to this age group (Forstinus *et al.,* 2015). Several factors are considered to be the leading causes of health threats among under-five children such as open defecation in some areas, poor hand washing practices, improper liquid and solid waste disposals, unsafe water sources for domestic uses (doubtful sources)(Freeman *et al.,* 2014; Mshida *et al.,* 2017). As reported by The Citizen (2018), an estimated 5 million Tanzanian still practice open defecation that is, they do not use latrine at all, which further contributes to associated infections mostly diarrhoea and mainly affecting under-five children. There is a strong link between sanitation and nutrition, which according to UNICEF (2018) is attributed to lack of adequate sanitation facilities; and this significantly cause stunting among children in Tanzania as around 38% of the mothers/ caregivers dispose faeces of their youngest child under age three unsafely.

1.2 Problem Statement

Provision of improved and consistent sanitation and hygiene practices plays an important role in ensuring human health and minimising the risk of communicable diseases. From literature, it is apparent that, poor sanitation and hygiene are still prevailing in Tanzania and are the main causes of waterborne and water-related diseases. It is evident that improved WASH practices have a significant impact on minimising incidences of WASH-related infections among infants and young children. The reports on sanitation and hygiene status in Tanzania focus on the relationship between sanitation, hygiene, and water supply but not on peoples' attitudes or perceptions towards water, sanitation and hygiene practices. It is notable that previous studies and reports on water, sanitation, and hygiene did not answer the question, "how do people's practices including awareness and behaviours contribute to the outbreak of such diseases?". Availability of water and sanitation facilities alone may not affect the spread of waterborne diseases. Perception often determines how much an act is being practiced, but knowledge indicates an understanding of a particular act. People’s perception rather than access to water, sanitation, and hygiene is likely to contribute to the outbreak of common infections within the households and the most crucial causes for their transmission. Therefore, this study aims at assessing WASH practices on diarrhoea among under-five children mainly focusing on awareness and practices of their caregivers.

1.3 Justification of the Study

The provision of sanitation and of other public services such as waste collection and disposal are still poor in Dar es Salaam. The situation is worse in informal settlements such as Keko Machungwa, Maguruwe where unsanitary conditions such as traditional pit latrines which are in poor conditions and not connected to a septic tank are a common feature (UCLAS, 2004; Kyessi and Sekiete, 2015). Studies (i.e., UCLAS, 2004; Kimani-

Murage and Ngindu, 2007; Sakijege *et al.,* 2012) reveal that groundwater such as polluted shallow wells, which is a common feature in informal settlements, raises water table causing overflows of pit latrines thus affecting sanitation. Other studies based on laboratory tests by Sakijege *et al.* (2012), revealed that water pollution levels consist of faecal coliform bacteria, which are pathogenic to human causing such diseases as typhoid and cholera. A study by Badowski *et al.* (2011), on understanding household behavioural risk factors for diarrheal disease in Dar es Salaam revealed that even where sources of drinking water are improved and uncontaminated, human behaviours contribute to the contamination of household supply of drinking water hence promoting transmission of pathogens. A study by Kamara *et al.* (2017), on examining the impact of a four-year intervention in rural Tanzania revealed that, despite increasing the number of sanitation facilities in the areas diarrhoea incidences among the under-fives were still increasing over the intervention period.

The government has made various efforts towards the provision of water to the people. For example, Dar es Salaam Water supply and Sanitation Authority (DAWASA) Salaam, which later changed to Dar es Salaam Water and Sewerage Corporation (DAWASCO) was established in Dar es Salaam (Kjellén, 2007). The national sanitation and hygiene campaigns were launched as a way of improving WASH practices and reducing associated infections. Despite the efforts, these interventions have so far received minimal attention in sanitation programs (Blumenthal *et al.,* 2018; Humphries *et al.,* 2018). The efforts made in addressing problems of WASH diseases in different areas in Dar es Salaam focus on water supply issues.

From the foregoing observations, studies have not related contamination levels of household drinking water to water handling, hygiene or sanitation practices. It is quite

possible that sanitation and hygiene practices rather than access is the key factor in the prevalence of WASH-related diseases in various areas. As per The Tanzania Development Vision (TDV) 2025, improving sanitation facilities, water supply, and hygienic practices can contribute to the achievement of high-quality livelihoods for its people, developing a strong and competitive economy and attain good governance. The Government of Tanzania has pledged (promised) to increase access to improved sanitation to 95% by 2025. The Second Five Year Development Plan (FYDP II) has also set the target for access to improved sanitation facilities at 85% in rural areas (WHO and UNICEF, 2019). Also, a network of civil society organization in Tanzania working in the water and sanitation sector known as Tanzania Water and Sanitation Network (TAWASANET), aims at strengthening the voice of civil societies in the national policy debates, capacity building, and promoting partnership with other sector stakeholders concerning water and sanitation (TAWASANET, 2019).

Therefore, the proposed study aims at expanding on the understanding of various contributing factors to the outbreak of common infections among under-five children. Also, the study will contribute knowledge to the existing body of accepted knowledge, especially on water use, sanitation and hygiene programs/projects such as the National Sanitation Campaign, Water Sanitation, and Hygiene, Sanitation and Water for All (SAWA), Dar es Salaam Water Supply and Sanitation Project (DWSSP), Water Sector Programme (WSP) and others.

The study addresses the United Nations Sustainable Development Goals (SDGs) number 6 (UN, 2015), whose thrust is to ensure availability and sustainable management of water and sanitation for all. It is also in line with the National Strategy for Growth and Reduction of Poverty II (NSGRP), Cluster II which focuses on improving the quality of

social services, in particular, Goal 4 which is on “increasing access to affordable clean and safe water; sanitation and hygiene” (URT, 2010).

1.4 Objectives

1.4.1 Overall objective

- The overall objective of this study was to investigate the effectiveness of *WASH* practices against *WASH* Related Infections among under-five children.

1.4.2 Specifically the study intended

- To examine peoples’ awareness and attitude towards water, sanitation and hygiene;
- To evaluate practices on water (use and management) in relation to sanitation and hygiene;
- To examine the presence and conditions of the existing sanitation and hand washing facilities.

1.5 Research Questions

i. How peoples’ awareness and practices towards water, sanitation and hygiene contribute to diarrhoea infections?

ii. How the existing sanitation and hand washing facilities contributes to diarrhoea infections?

iii. What efforts are being made to attain improved sanitation in line with improved latrine?

iv. How do people manage their solid and liquid wastes within the community?

1.6 Conceptual Framework

The variables for this study were captured in a conceptual framework as depicted in Figure 1. The independent variable for the proposed study was diarrhoea infection. The dependent variables for the proposed study were WASH practices. The intervening variables were communication channels such as information sources, effective media and message, and other influencing factors such as the available government and non-governmental programmes, community participation and religious factors.

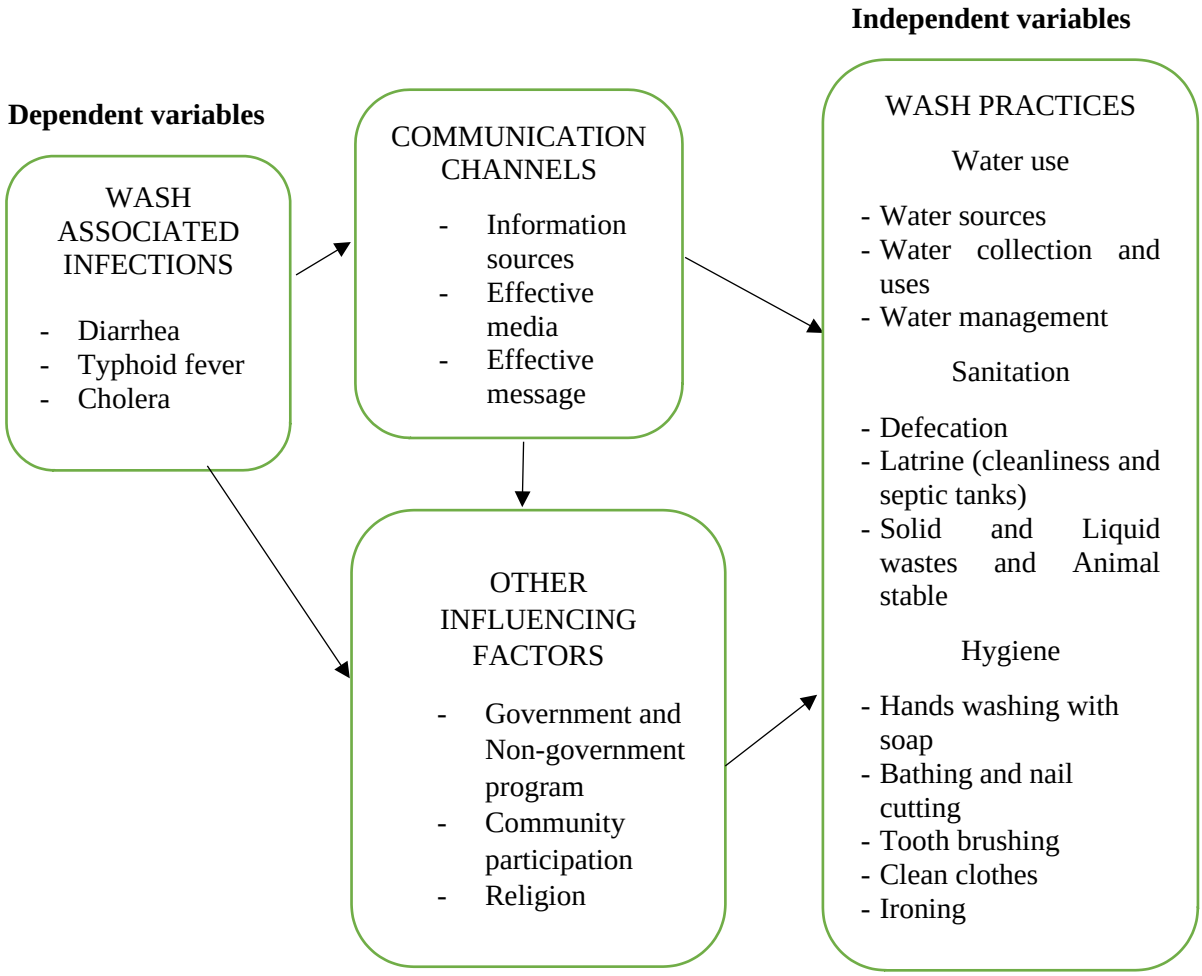

Figure 1: Conceptual framework for variables used in the study

1.7 General methodology

The study was cross-sectional in nature employing a mixed method approach where by qualitative data from key informants and quantitative data from household member were collected. The study was conducted in three selected wards namely Tandika, Mtoni and Azimio from Temeke Municipality through a simple random sampling method. The study population was mothers/ caregivers with under-fives as the main focus and a total of 220 respondents were selected for interviews. Descriptive statistics were computed and logistic regression model was used to identify factors associated with outcome variable.

1.8 Organisation of the Dissertation

The dissertation is organised in four chapters. The first chapter consists of the extended abstract and introduction of the overall study. In addition, it describes the concepts presented in the manuscripts. The second chapter consist of publishable manuscript which covers objectives one and two and provides answers for research question 1 and 2. The third chapter consists of publishable manuscript, which covers objective three and provides answers for research question 3. The fourth chapter presents the study's general conclusions and recommendations.

1.9 Limitations and Strengths of the Study

The study had some limitations first, the available literatures, which were used as references focused on water supply and sanitation, knowledge and attitude towards sanitation and hygiene, availability and conditions of latrine especially in rural settings, urban areas and in schools with no proper link on how people's attitude and behaviours can influence incidences of communicable diseases. Thus there is a need for further research in areas such as urban slums and informal settlements where the situation is

worse. Second, the analysis of previous studies based on general information provided by all respondents for generalisation hence there is a need for data isolation with appropriate measures in order to come up with causal inferences as to whether there are specific linkages between factors such as socio-economic, contextual factors and communicable diseases. Fourth, the selected study area was small compared to the areas focused by previous studies; furthermore, the cross sectional nature of the study limited the study from making a comprehensive analysis of cause-effect relationship hence there is a need for further investigation on that matter.

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CHAPTER TWO

2.0 KNOWLEDGE AND PRACTICES ON WATER, SANITATION, HYGIENE AND WATERBORNE DISEASES AMONG UNDER-FIVE CHILDREN IN TEMEKE DISTRICT, DAR ES SALAAM

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2.1 Abstract

This study aimed at assessing peoples' knowledge and practice towards water, sanitation, hygiene, and water-borne diseases. A cross-sectional study was conducted in Temeke Municipality, Dar es Salaam region involving 220 respondents, randomly selected from Tandika, Azimio, and Mtoni wards. The study employed a mixed-method approach involving quantitative data from the household survey and qualitative data from key informant interviews. Quantitative data were analyzed using IBM-Statistics SPSS windows version 20.0 and qualitative data were analyzed with the help of content analysis. The findings revealed that the majority (40% and 36.9%) of the respondents depend on public taps and private water vendors to get water and only 16% treat their drinking water by boiling. Furthermore, respondents acknowledged the importance of hand-washing at critical times. Only 31.7% and 62.6% use soap to wash their hands before and after meals respectively. The majority (73.4%) wash hands after visiting the toilet and the major reason given for that was to prevent transmission of diseases. Diarrhoea was among the widely known waterborne disease in the area that was mainly affecting under-five children (10.4%). The study concludes that respondents have a satisfactory understanding of

sanitation and hygiene although the practices are still disappointing. The study recommends that any efforts to improve access to sanitation and hygiene have to be joined with strategies to promote effective utilization of such services.

Keywords: Sanitation, Hygiene, Hand-Washing practices, Water-borne Diseases, Temeke Municipality

2.2 Introduction

Water, sanitation, and hygiene (WASH) are critical determinants of human health and their health impacts significantly increase the rate of under-five mortality mostly in developing countries. It is estimated that over 2 billion people worldwide drink water that is contaminated with faeces and around 4.5 billion families use inadequate sanitation systems that pose harm to their families (WHO, 2018). Globally, communicable diseases such as diarrhoea account for about 4.1% of the burden of disease especially in developing countries where access to safe drinking water is still a challenge (WHO, 2017). Diarrhoea remains the leading cause of mortality and morbidity among under-fives at an estimate of 502 000 children exceeding the mortality rates of malaria and tuberculosis combined (Mshida *et al.,* 2017; WHO, 2018; Zahid, 2018).

In Tanzania, the government spends an estimated 70% of its health budget on preventable WASH-related infections. This is because the majority of the population do not have access to improved sanitation and around 46% do not have access to clean drinking water (UNICEF, 2017). As reported by TDHS - MIS (2016) the use of unimproved sanitation and poor hygienic practices contribute up to 12% of the childhood illnesses especially diarrhoea among the under-five resulting in high mortality of that age group. In addition, 80% of the rural residents still use inadequate and unimproved sanitation facilities while in urban areas it is as low as 2% coverage (WHO, 2018). Communicable diseases especially

water-borne diseases could be managed easily and effectively by the improvement of general sanitation conditions and hygienic behaviours (Safari *et al.,* 2019). Sanitation problems at the household level especially in low-income areas are not fully recognized by the government hence much effort is seen in the provision of water supply treating sanitation as the last option in the political agenda and budget reservations (Tuju, 2015; DAWASA Business Plan 2013/2016).

In Dar es Salaam city especially in the informal settlements such as Temeke Municipality sanitation provision is still poor as pit latrines are in adverse conditions, sewage systems are damaged, and management of water resources is not of much concern (Sakijege *et al.,* 2012). Studies (i.e. Van Dijk, 2014; Kasala *et al.,* 2016) done in some informal settlements of Temeke Municipality such as Keko Machungwa, Ukonga, and Majumba sita revealed that groundwater often rises above the water-table resulting in an overflow of pit latrines and pollution of the shallow wells . A study by Kumi-Kyereme and Amo-Adjei (2016) in Temeke Municipality suggests that education levels, poor quality of water storage containers, and unimproved sanitation facilities are among the major contributing factors for poor WASH practices among households in the area.

The National Sanitation and Hygiene Campaigns was launched in 2012 as a way of improving WASH practices and reducing the associated infections yet these interventions have received minimal attention in sanitation programs up to date (Blumenthal *et al.,* 2018; Humphries *et al.,* 2018). Efforts made to address problems of WASH diseases in different areas in Dar es Salaam mainly focus on the issue of water supply. Several studies (Sakijege *et al.,* 2012; Mshida *et al.,* 2017; Blumenthal *et al.,* 2018) have linked poor sanitation and hygiene practices of the people with the transmission of WASH-related infections. These studies however have not looked at the understanding of such aspects.

WASH-related infections among under-five occurring in Temeke Municipality may be associated with poor understanding of mothers/ caregivers on issues related to water use, sanitation, and hygiene. Therefore, the main objective of this study was to assess mothers' knowledge and practices regarding water, sanitation, hygiene, and water-borne diseases in three wards of Temeke Municipality for the implementation of recommended strategies against WASH-related diseases specifically diarrhoea. Specifically, the study aimed at examining peoples' knowledge and practices on sanitation, hygiene, and associated infections. Secondly, the study aims at evaluating practices on water (use and management) concerning sanitation and hygiene.

This study intended to fill some of the scientific gaps by expanding on the understanding of various factors that might be contributed to the outbreak of common infections among the under-five children. The findings of this study will contribute knowledge to the existing body of literature on programs/ projects concerning water use, sanitation, and hygiene such as the National Sanitation Campaign (NSC); Water, Sanitation, and Hygiene; Sanitation and Water for All (SAWA); Dar es Salaam Water Supply and Sanitation Project (DWSSP); and Water Sector Programme (WSP). The study aims to help stakeholders including end-users, local government authorities, government and non-government institutions in improving health promotions regarding sanitation and hygiene. The study addresses the United Nations Sustainable Development Goals (SDGs) number 6 (UN, 2015) whose thrust is on ensuring availability and sustainable management of water and sanitation for all.

2.3 Methodology

2.3.1 Description of the study area

The study was conducted in Temeke District, Dar es Salaam region 39° 12' - 39° 33' East and 6° 48' - 7° 33' South. Until 2016, Temeke was estimated to have 1 443 629 people and 368 416 households with an average population growth rate of 4.6% per annum (see Figure 2) (Temeke Investment Profile, 2018). Temeke is the industrial district of the city where the manufacturing centres (heavy and light industry) are located and the port of the city is found in the Eastern side of the area. The area was selected, as it is one among the districts with high concentration of unplanned settlements and medium-low income residents whose sanitary conditions are poor (Kihupi *et al.,* 2016; URT, 2019). Furthermore, the majority of the residents have low understanding of issues regarding water use, sanitation, and hygiene as supported by several studies (Chaggu *et al.,* 2002; Kasala *et al.,* 2016; Kihupi *et al.,* 2016; URT, 2019).

Figure 2: Map of Temeke Municipality showing selected wards

Source: Kacholi and Sahu (2018)**.**

2.3.2 Research design

The cross-sectional design was employed for the study whereby primary data were collected at one point in time (Neuman, 2014). Data were obtained through household interviews with mothers and or caregivers with the under-five children as a top priority followed by those with children below 7 years. The eligibility criteria for the study was

being a mother or caregiver with at least one under-five child. If an eligible household contained more than one mother or caregiver with an under-five child, Kish grid technique was employed to randomly select one mother / caregiver for the interview (Kish, 1949). If the selected mother or caregiver contained more than one under-five child, same technique was used to randomly select one child to be involved in the study. This method avoids selection bias as it involves constructing a list of eligible individuals at a particular label then selecting based on the number of the label itself (Lewis-Beck *et al.*, 2003).

2.3.3 Sampling procedure

A probability sampling method was employed whereby simple random sampling was used to select the study area and study population. The study population was mothers/ caregivers with the under-five children living in Temeke District, as they are the ones taking care of children in a family. The researcher with the help of Temeke Municipal officials from the Department of Sanitation and the Environment obtained the list of 24 wards. A lottery method was used to select three wards out of 24 wards obtained in the list namely Tandika, Mtoni, and Azimio. A list of streets was generated according to the above-selected wards, Tandika had six streets, Mtoni had also six streets, and Azimio had eight streets. A lottery method was again employed to select three streets from each ward making nine streets. The sample size was then divided according to selected streets to ensure equal representation of respondents that is, Tandika 75, Mtoni 75, and Azimio 70. The study population, which involved mothers / caregivers with the under-five children, was selected with the help of street representatives appointed by the Ward Executive Officer, as they did not have a list of households with the under-five children specifically. In every street selected, one out of five households was randomly selected for interviews and observations.

The total number of households to be selected were 196, containing households with the under-five children. Degree of accuracy in sample size determination was set at 7%, in between 5-10%, which is acceptable error resulting to a minimum required sample size of 196 respondents. Due to the resources available, the study managed to include up to 220 respondents. Therefore, a total of 220 mothers / caregivers were successfully interviewed and included in the analysis.

2.3.4 Sample size determination

The total sample size was estimated with the help of a formula by Fisher *et al.* (1991) for larger populations (exceeding or equal to 10,000) as shown below,

$$n = \frac{z^2 \times p \times (1-p)}{d^2}$$

Where;

n = is the sample size required; z = standard normal deviation, set at 1.96 corresponding to 95% confidence level; p = proportion in target population with features of interest (unknown, use 50%); 1 - P = (1 - 0.5) = 0.5 (Expected non-prevalence); d = degree of accuracy desired, set at 0.07 (7%)

$n = (1.96)^2 \times 0.5 \times 0.5 / (0.05)^2 = 3.8416 \times 0.25 / 0.0049$

n = **196**

Therefore, 196 respondents (mothers / caregivers) from Tandika, Mtoni and Azimio wards were used as the sample size of the study.

2.3.5 Data collection

Data were primarily obtained from inhabitants of Tandika, Mtoni, and Azimio Wards through the administration of a structured questionnaire and observation technique. Quantitative data were collected on respondents' (mothers / caregivers) knowledge and practices towards water, sanitation and hygiene, and waterborne diseases. Qualitative data

were collected through key informant interviews with streets and ward representatives, and street and ward health officials. Observation method was used to capture and ensure the practices on household sanitation including latrine facility condition and hand hygiene.

2.3.6 Data Analysis

The collected data were analysed using IBM-Statistics SPSS windows version 20.0. Descriptive analysis was employed to analyse the households' perception and practices towards the water, sanitation, and hygiene and waterborne diseases and presented in graphs and frequency tables. The respondents' level of knowledge was measured through ordinal level of measurement as a categorical measurement level that is high and low whereby frequencies and percentages were computed. Overall knowledge and practices of the respondents towards the water, sanitation, and hygiene and waterborne diseases above 50% were regarded as high and below 50% were regarded as low using a cutoff point of 110 (50%) total number of respondents. Content analysis was employed for qualitative data collected from key informants to add value to the quantitative data collected. The binary logistic regression model was used to estimate key factors associated with diarrhoea incidence. The binary logistic regression model was specified as follow;

$$Y = \text{Ln}\,(P/\,(1 - P)) \quad \ldots\ldots (1)$$

$$Y = \text{Ln}\,(P/\,(1 - P)) = \beta o_{(\text{constant})} + \beta_{1(\text{regression coefficients})} X_{i1(\text{Age})} + \beta_2 X_{i2(\text{Marital status})} + \beta_3 X_{i3(\text{Education level})} + \beta_4 X_{i4(\text{Income sources})} + \beta 5\, X_{i5(\text{Water sources})} + \beta 6\, X_{i6(\text{Water safety measure})} + \beta 7\, X_{i7(\text{Hand washing practices})} + \varepsilon i_{\,(\text{Random error term})} \quad \ldots\ldots\ldots (2)$$

Source: (Hoffman, 2004)

Where:

Y = Dependent binary variable (contacted with diarrhoea = 1, not contacted = 0), P = Probability of being contacted with diarrhoea, 1 – P = Probability of not being contacted with diarrhoea. Ln = Natural logarithm function

Table 1: Description of variables used in the Logistic Regression model

Variables	Description	Measurement
Age	Actual age of respondents	Age in complete years
Marital status	Marital status of respondents	1 = Married 0 = Otherwise
Education level	Education level of respondents	1 = Secondary and tertiary level 0 = Otherwise
Income sources	Income sources of respondents	1 = Self-employed 0 = Otherwise
Water sources	Water sources used by respondents	1= Piped into the house 0 = Not piped into the house
Water safety measures	Water safety measures used by respondents	1= Let water settle 0 = Otherwise
Hand washing practices	Hand washing before meals with soap	1 = Yes, with soap 0 = No soap
	Hand washing after meals with soap	1 = Yes, with soap 0 = No soap

2.4 Findings

2.4.1 Socio demographic features of respondents

In Table 2, out of 220 respondents, 16% were within the age range of 18-25 years, 32.7% were within the range of 26-33 years, and 26.4% were within the range of 34-40 years. The majority (67%) were married, 16.9% were single with an average family size of four

and more people per household. The majority (72%) had basic education, 23% completed secondary school. Moreover, 47.7% were mainly engaged in small businesses such as a kiosk, selling bites and fried fish just outside their houses, tailoring, and ice creams.

Table 2: Socio-demographic information of respondents (n=220)

Variable	Category	Frequency	% (%)
Age (in complete years)	18 – 25	37	16
	26 - 33	75	32.7
	34 – 40	58	26.4
	41 and above	50	21.5
	Total	**220**	**100**
Marital status	Married	147	67
	Engaged	34	14.8
	Single	39	16.9
	Total	**220**	**100**
Educational level	Primary level	158	72.0
	Secondary level	53	23.0
	Tertiary level	1	0.4
	No formal education	8	3.5
	Total	**220**	**100**
Household size	< 5 years	203	92.3
	No > 5 children	17	7.0
	Total	**220**	**100**
	> 5 years and adults	220	100
	Total	**220**	**100**
Income-generating activity	Self-employed	196	87.3
	Casual labour	16	6.9
	Official employment	2	0.9
	Housewife	6	2.6
	Total	**220**	**100**

2.4.2 Main sources of potable water, storage facilities, and water purification measures by the Respondents

Water use and management were assessed based on self-reporting and observation of actual sources of water and storage facilities used. The majority (40%) of households depends on public taps/ standpipes "visima," while 36.9% get water from public water kiosks most of which are dug wells covered with concrete on top and from neighbours (private) who own water wells. In addition, 10.9% get water from small-scale water vendors including pushcarts and borehole water vendors where one can carry up to 15 gallons of water. In addition, a 20ltr bucket was sold at 50 – 200 TZS depending on where the vendor gets the water. In addition, 8.2% use piped water that goes directly to their house and 14.3% use piped water where the pipes are inside their plots connected to a stopcock. The majority (64.7%) of the respondents use buckets with a lid to store water, 22.1% use jerry cans with a lid, and 1.7% use water drums ranging from 80 – 160 litres. The respondents do not consider cleaning sanitation facility (25.2%) or hand washing (17.4%) as part of their water use. in other words, there are no specific water containers for keeping water for such uses. In addition, daily water consumption within the household ranges from 20 - 200 litres in both dry and rainy seasons covering up to more than 85% of water uses for all households. The water safety measure used by the respondents was boiling (16%) and only 4 (1.7%) reported using chemicals such as water guard.

Table 3: Main sources of water for daily domestic activities and treatment methods (n=220)

		Azimio (n = 70)		Mtoni (n = 75)		Tandika (n = 75)		Total (n=220)	
Category	**Variable**	**Freq.**	**Per. (%)**	**Freq.**	**Per. (%)**	**Freq.**	**Per. (%)**	**Freq.**	**Per. (%)**
Water sources	Piped into the house	5	6.3	13	17.3	1	1.3	**19**	**8.2**
	Public water kiosk	31	38.8	9	12	45	60	**85**	**36.9**
	Piped to yard	2	2.5	24	32	7	9.3	**33**	**14.3**
	Public taps/ standpipes	47	58.8	27	36	18	24	**92**	**40**
	Small scale water vendors	4	5	3	4	4	5	**11**	**4.7**
Safety measures	Boil	10	12.5	15	20	12	16	**37**	**16**
	Let water settle	73	91.3	56	74.7	56	74.7	**185**	**80.4**
	Chemicals e.g. water guard	1	1.3	3	4	-	-	**4**	**1.7**
	Bottled water	1	1.3	2	2.7	-	-	**3**	**1.3**

2.4.3 Knowledge and practices towards Sanitation and Hygiene

2.4.3.1 Hand-washing practices

Hand washing practices were assessed through self-reporting data. Respondents admitted that, it is important to wash hands soon after visiting the toilet the underlying reasons however varied widely. Among the reasons given, include prevention of disease transmission, which was mentioned by 63.7% of the respondents in Azimio. About 70.7% in Mtoni and 86.7% in Tandika Wards mentioned cleaning of hands as a reason; 40% of the respondents in Azimio, 52% in Mtoni, and 48% in Tandika, and only 1.3% from Mtoni

wards cited cultural/ religious practice as a reason of hand washing. Overall, 63.4% suggested that it is a healthy practice to wash hands soon after using the toilet and 16% indicated that it is important to wash hands as prevention from food contamination. Hand washing with soap before meals was practiced by a few (31.7%) while the majority (62.6%) do so after meals. The major reasons identified for washing hands before meals include cleaning hands to remove dirt (22.6%) and killing infectious germs (bacteria) (reported by 7.4%) and reasons for washing after meals include getting rid of bad smell "shombo" (45.2%) and removing stickiness from the hands (14.7%) as shown in Table 4. The overall perception of respondents towards hand washing practice varied. The major reason suggested includes being common /cultural practice, reported by 73.8% for Azimio, 62.7% for Mtoni, and 78.7% for Tandika. Other reasons include it is a healthy practice, 16% from Mtoni, 38.7% from Tandika, and none from Azimio; it helps to prevent infections (diseases), reported by 16% from Mtoni, 29.3% from Tandika, and only 5% from Azimio (Figure 3). The overall perception towards hand washing was based on a practice being common to everyone and not otherwise.

Table 4: Hand washing practices (n=220)

		Azimio (n = 70)		**Mtoni (n = 75)**		**Tandika (n = 75)**		**Total (n=220)**	
Category	**Variable**	**Freq.**	**Per. (%)**	**Freq.**	**Per. (%)**	**Freq.**	**Per. (%)**	**Freq.**	**Per. (%)**
Hand washing	Before meals with soap	18	22.5	25	33.3	30	40	**73**	**31.7**
	After meals with soap	45	56.3	44	58.7	55	73.3	**144**	**72.6**
Reasons									
Before meals with soap	Dirty hands (cleaning)	13	16.3	14	18.7	25	33.3	**52**	**26.6**
	Infectious germs (bacteria)	3	3.8	8	10.7	6	8	**17**	**7.3**
After	Bad smell	36	45	30	40	38	50.7	**104**	**45.2**

meals with soap									
	Oily hands	8	10	20	26.7	6	8	**34**	**14.7**
	Healthy	-	-	-	-	2	2.7	**2**	**0.9**

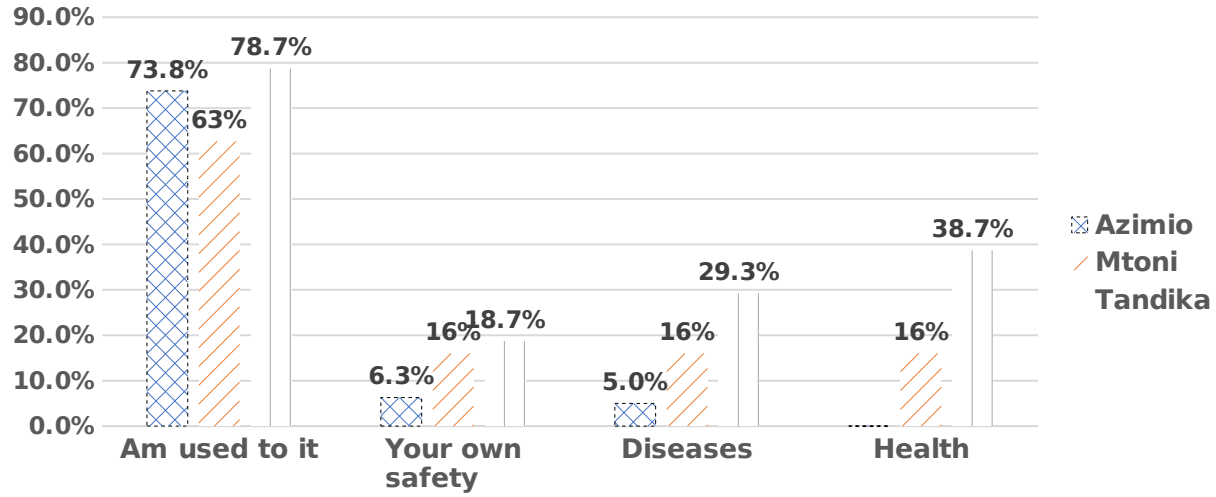

Figure 3: Respondents' overall perception towards hand-washing practice

2.4.3.2 Latrine utilization and disposal of child stool

Knowledge and practices towards sanitation and hygiene in this section were assessed based on self-reporting data and the observation of proxy indicators based on the design of the latrine facility and its overall condition, and the disposal of child stool. The findings indicate that, 57.5% of the respondents from Azimio, 85.3% from Mtoni, and 72% from Tandika agreed that the construction of better quality and proper utilization of latrines could reduce the incidences of waterborne diseases. The suggested reasons include, good design of the facility with enough space and ventilators suggested by 42.1%, having a clean toilet and its overall environment (41.7%), and water availability within the facility at all times can help to keep the facility clean suggested by 32.1%. No latrine sharing was among the added reasons as reported by 36.3% of the respondents from Azimio, 22.7% from Mtoni, and 28% from Tandika. The respondents (72%) dispose child faeces by throwing it into the latrine, which was among the good sanitation practice. Other practices

include thrown faeces into the garbage (9.3%) and allowing the children above 5 years to use the toilet (10.7%). The overall knowledge on latrine quality and condition was 59%, based on the chosen criteria to measure knowledge, this was regarded as high.

2.4.3.3 Personal hygiene behaviours

As for personal hygiene behaviours, bathing (79.1%) and wearing clean clothes that is washing clothes (43.4%) were the major identified personal hygiene behaviours. Others cited tooth brushing (35.6%), and hand washing (19.5%) although they did not specify hand washing with soap or plain water (Figure 4). The overall perceived knowledge concerning personal hygiene activities was 36.4%, which is regarded as low knowledge.

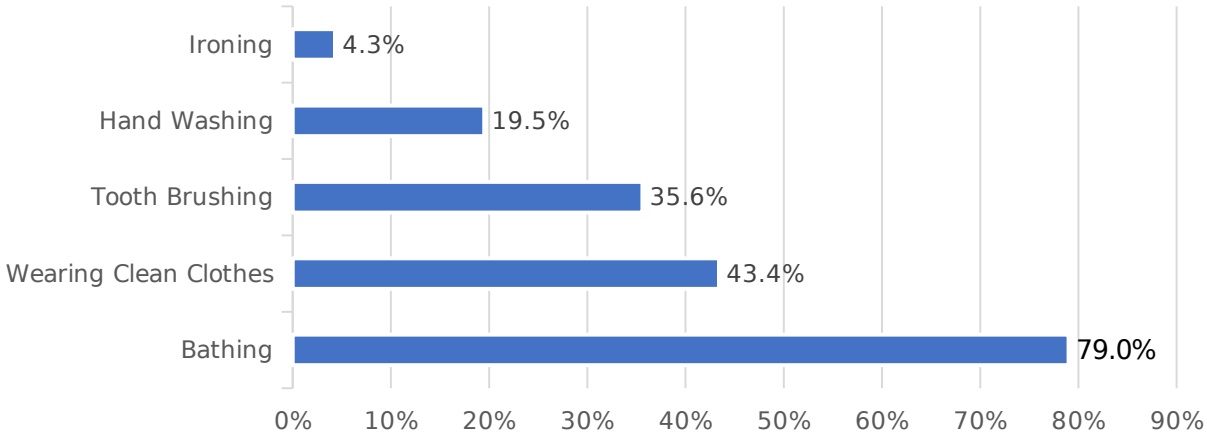

Figure 4: Respondents' awareness on personal hygiene activities

2.4.3.4 WASH-Related infections

Data on WASH-related infections among the under-five was based on self-reporting from mothers/ caregivers. Some of the interviewees agreed that their children have had diarrhoea in their lifetimes. Diarrhoea was the common infection reported accounting for 10% of all other infections followed by cholera (7.8%). Overall, the group that was mostly affected by these infections was the under-five children (10.4%). The majority of the mothers / caregivers interviewed reported to have some level of knowledge regarding

waterborne diseases and their preventive measures. The respondents gave diverse responses as to the preventive measures against the mentioned infections, 76.5% mentioned environmental cleanliness, that is proper waste management. Moreover, 32.5, 22.7, and 17.3% of the respondents from Azimio, Mtoni, and Tandika respectively suggested self-cleanliness and food safety (from preparation to eating) as preventive measures against the mentioned infections (Table 5). Based on diverse responses given, the overall knowledge concerning WASH-related infections and their countermeasures was above 50% which is regarded as high.

Table 5: Knowledge on WASH-related infections: Incidence and prevention measures (n=220)

Category	Variable	Azimio (n = 70)		Mtoni (n = 75)		Tandika (n = 75)		Total (n=220)	
		Freq.	**Per. (%)**	**Freq.**	**Per. (%)**	**Freq.**	**Per. (%)**	**Freq.**	**Per. (%)**
Incidence	Diarrhoea	9	11.3	8	10.7	6	8	**23**	**10**
	Typhoid	2	2.5	2	2.7	1	1.3	**5**	**2.1**
	Cholera	8	10	6	8	4	5.3	**18**	**7.8**
Group affected	Children < 5 years	10	12.5	7	9.3	7	9.3	**24**	**10.4**
	Children > 5 years	2	2.5	4	5.3	-	-	**6**	**2.6**
	Youth and adults (18-35) years	4	5	3	4	1	1.3	**8**	**3.4**
Preventive measures	Environmental cleanliness	58	82.8	54	72	54	72	**166**	**75.4**
	Frequent toilet cleaning	1	1.3	2	2.7	24	32	**27**	**11.7**
	Boiling water	1	1.3	14	18.7	5	6.7	**20**	**8.6**
	Awareness	3	3.8	1	1.3	3	4	**7**	**3**
	Food safety	26	32.5	11	14.7	5	6.7	**42**	**18.2**
	Hand-washing	-	-	7	9.3	19	25.3	**26**	**11.3**
	Self-cleanliness	26	32.5	17	22.7	13	17.3	**56**	**24.3**

2.5 Factors associated with diarrhoea incidence

The results of the binary logistic regression model on the key factors associated with respondents contacting diarrhoea are presented in Table 6. The Overall Wald statistics was significant ($p = 0.000$ i.e. $p < 0.05$); the overall model was well predicting the outcome. The chi-square for the Omnibus Tests of Model Coefficients was not significant ($p = 0.215$, i.e. $p > 0.05$); the overall model was not well predicting the outcome. The chi-square for the Hosmer and Lemeshow Test was not significant ($p = 0.433$, i.e. $p > 0.05$). The Nagelkerke R^2 that was 0.082 shows that the independent variables entered in the model were able to predict only about 8.2% (i.e. 0.082 x 100) of the variance of the dependent variable. Out of eight independent variables entered into the binary logistic regression model, only one i.e. hand washing with soap before meals ($p \leq 0.05$) was significantly associated with respondents' contacting diarrhoea.

Hand washing with soap before meals had a positive effect and greatest effect on the chances of the respondents getting diarrhoea as it has the greatest Wald statistic. Age, marital status, income sources and hand washing with soap after meals were not significantly associated with respondents contacting diarrhoea and they had negative B-values. Variables like water sources, water safety measures, educational level were not significantly associated with respondents' contacting diarrhoea though they had positive B-values, albeit their Exp(B) values were above 1.0 which means the variables increases the odds of respondents getting diarrhoea.

Table 6: Binary Logistic Regression analysis of factors associated with respondents contacting diarrhoea and not being contacted (n=220)

Independent variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Age	-.024	.024	1.080	1	.299	.976	.932	1.022
Marital status	-.333	.389	.733	1	.392	.717	.334	1.536
Education level	.224	.458	.240	1	.624	1.251	.510	3.068
Income sources	-.247	.613	.162	1	.687	.781	.235	2.598
Water sources	.391	.669	.342	1	.559	1.479	.398	5.492
Water safety measures	.110	.440	.062	1	.803	1.116	.471	2.642
Hand washing with soap before meals	.971	.409	5.627	1	.018*	2.641	1.184	5.893
Hand washing with soap after meals	-.270	.453	.355	1	.551	.764	.314	1.854
Constant	-1.663	1.090	2.325	1	.127	.190		

* significant level at $P \leq 0.05$.

Dependent variable = diarrhoea incidence, Overall Wald statistics = 73.316 (p = 0.000); Omnibus Tests of Model Coefficients Chi-square = 11.968 (p = 0.215); Hosmer and Lemeshow Test Chi-square = 8.005 (p = 0.433); -2log Likelihood = 212.136[a]; Cox and Snell $R^2 = 0.051$; Nagelkerke $R^2 = 0.082$ model is not well predicted at 8.2%.

2.6 Discussion

The study found that the majority (76.9%) depend on public taps and small scale water vendors as their main water sources. This implies that, most informal settlement dwellers in Dar es Salaam depend on other sources of water including boreholes, private taps,

tanker trucks and protected wells, which are the most reliable sources of water supply as the public water supply company covers less than half of the city's population. Similar findings are reported in a study done in Goba, Dar es Salaam that residents in low-income areas depend on other water sources such as boreholes as the government has failed to provide water services to cope with the rapid increase of population (Sakijege, 2019). Scarcity of water in the city together with a rapid increase in population increases the room for more private water suppliers, as they are safe and reliable though the cost is higher compared with the official rates charged by DAWASCO. The quality of water supplied by private proprietors and the related health risks are still questionable as no traceable studies examined the risks of the use of groundwater (Kombe *et al.,* 2015; Sakijege, 2019). Daily water consumption by households in both dry and wet seasons was reported to be 20 - 200 litres based on varying prices depending on the source. Different water suppliers have different prices, for instance, for public sources; the price is 100 TZS while for private taps and vendors is 200 – 400 TZS indicating the addition of 200 TZS hence hampering the daily household water consumption needs. The study findings indicate that the rapid population increase in the city continues to increase water demand and based on the fact that water has no substitute (UNICEF and WHO, 2012), people will go for whatever source of water available regardless how much it costs. Similar findings are reported in a study done in the informal settlements of Dar es Salaam that households served with private water suppliers spend more money in purchasing water compared to those served with public water supply company (Dakyaga *et al.,* 2018). Given that more than half of informal settlement dwellers fall under low-income category, the cost challenge interferes with their daily water consumption needs. In addition, it is evident that there is water scarcity in the households' premises that are being supplied by the public company such as DAWASCO. Hence, people dig their wells to meet the needs of water supply as one of the participants from Kichangani Street had this to say,

> *"...Temeke is being supplied with water from the Ruvu basin through a constructed pipe from the basin up to the city. However, there are some issues with the pipe that water is not available all day for more than a week so some people decided to dig their well near their premises to keep up with their daily water need. For those with private wells, they also sell water to those in need and the price varies depending on the storage container used i.e. 20 litre bucket is sold at 100 TZS, 10 litre bucket for 50 TZS..."* (Key informant respondent from Tandika ward on 6th April 2019).

The study found that nearly one in five (16%) of the households, which was very low %age, treat their drinking water by boiling. This implies that there is limited understanding of the risks associated with drinking untreated water. Furthermore, the quality of water provided by private proprietors is neglected as long as water is safely and constantly available. A similar study conducted in Ethiopia indicated that nearly one in five (18.3%) households treated drinking water at a household level (Berhe *et al.*, 2020). These differences might be attributed to variations in socio-economic status and the selected sample size. However, this practice of reducing diarrhoea infections at household level has been poorly documented. This is partly due to poor storage and handling mechanisms leading to re-contamination after boiling. From study findings, the majority do not apply any treatment methods for drinking water, as they believe that, the water sold by private water suppliers is safe for drinking. Similar findings are reported in a study in Nepal, which indicated that 86.4% of all the households did not treat their drinking water (Shrestha *et al.*, 2017). In addition, the practice of the respondents treating their drinking water as observed from the study was very low. This implies that the fight against the outbreak and spread of communicable diseases is still low as the primary preventive

measure of some of the communicable diseases is through treating drinking water, which ensures that drinking water is free from contamination of pathogens.

As for Hand washing during critical times such as after visiting the toilet, the findings of present study in another study in Iringa, which reported that respondents acknowledge the importance of washing hands during critical times such as after using the toilet, and before having a meal and after feeding a child (Lufingo, 2019). This indicates that the respondents prevent themselves from contacting infections related to faecal contamination such as Escherichia coli and hepatitis. It is a common practice for people to wash hands after visiting the toilet but few understand the health importance of the practice. Hand washing with soap before and after meals shows some distinction with the majority doing so after meals. This implies that the majority of the respondents perceive hand cleanliness as the removal of food remains instead of microorganisms implying that most times their hands are contaminated with pathogens and other dangerous microorganisms. This finding concur with the findings from a study in Palestine that respondents practice hand hygiene with the majority doing so after meals and this practice can be protective against risk of diarrheal incidence (Abuzerr *et al.*, 2019). The overall perception of respondents towards hand washing seems to rely on the common nature of the practice that is everyone is doing it. From this information, it can be concluded that poor hand hygiene might be caused by low education level of the respondents as the majority (72%) had only basic education (Table 2) hence they cannot understand the importance of hand hygiene and its related health risks. From study findings, hand washing practices were observed to be very poor at critical times which implicates that hand hygiene among mothers/ caregivers is still questionable.

In the present study, respondents acknowledge the importance of having a properly designed and well-managed latrine facility in reducing WASH-related infections. The findings from the present study concur with the findings in a study by Weststrate *et al.* (2019) that poorly managed sanitation facilities can infiltrate pit latrines causing environmental pollution and diseases suggesting that pit latrines should be properly constructed and well-managed. The respondents agreed to have a well-designed latrine facility because the nature and design of sanitation facilities around the areas were of low quality with multiple damages caused by the facility being too old, lack of repair, and shared by many households. Respondents' knowledge on proper latrine utilization was high; this can be confirmed by a key informant from Mtoni ward, who said,

> *"... In our ward (Mtoni), the available latrines are satisfactory for daily use though some are in bad shape and pose health risks to the surrounding households as majority share latrines. On top of that, recently people start constructing modern latrines like the flush toilets with some decorations inside including tiles..."* (Key informant respondent from Mtoni ward 9th April 2019).

The majority dispose child's faeces collected from baby diapers and rinse them in their toilets or septic tanks while others throw them into the garbage. This implies that the safe disposal of child's faeces as perceived by majority of the respondents was through throwing them into the latrine or septic tank, which indicates poor management practice of sanitation facilities in particular, septic tanks. Similar findings are reported in a study in Ethiopia that majority dispose child faeces into the toilet as they use open pits toilets (Abera *et al.,* 2018). This is because of the nature of latrine facilities used in the area, which were pit latrines making it easy for them to throw the faeces unlike those with flush toilets, which forced them to throw faeces into the garbage. This implies that the contamination of well water by poorly managed pit latrines might be caused by throwing hard material into the pits making it hard during dewatering of faecal sludge and pit

emptying hence the pit remains full for quite some time. This further implies that the under-five children are more vulnerable to communicable diseases considering the low understanding of safe sanitation practices of their caregivers and their playing grounds which might be contaminated with pathogens and other harmful micro-organisms.

Concerning personal hygiene, bathing, and washing clothes were highly reported by majority of the households. These findings imply that the respondents are more concerned with some hygiene practices that are considered important. This might be caused by low understanding of behaviours related to personal hygiene, scarcity of water and availability of few hand washing points with all the required essentials. A similar study in Bangladesh found that respondents ration and re-use their water supply for cooking and drinking due to water scarcity hence reporting poor personal hygiene behaviours such as bathing and washing clothes (Farah *et al.*, 2016). This difference might be attributed by the nature of the study areas and the selected sample. Knowledge concerning personal hygiene activities was observed to be very poor among study participants. This implies that, among other factors, personal hygiene activities practiced among the under-fives might be contributing factors for diarrheal incidence among that age group.

The most common WASH-related infection was diarrhoea, which mostly affected the under-five children. It appears that the under-five children are most vulnerable to waterborne diseases considering the safety of their playing grounds, which are awash with various pathogens, and the level of understanding of issues related to sanitation and hygiene among their caregivers. Similarly, a study in Cameroon reported that respondents were knowledgeable on the occurrence of waterborne diseases, vulnerable groups and the complications associated with such infections (Fonyuy, 2014). The respondents acknowledged the root causes of diarrhoea infection being drinking contaminated water, poor hygienic measures, poor sanitation, and the general environment. A similar study in

Rwanda (Nahimana *et al.,* 2017) and Ethiopia (Abera *et al.,* 2018) revealed that respondents were aware of the factors associated with waterborne diseases and their preventive measures. Knowledge concerning WASH-related infections and associated risks was high as it was also explained by a participant from Tandika ward, who said,

> *"...Nowadays people are aware of the waterborne diseases caused by the use of contaminated water and poor sanitary conditions. Some are taking precautions by treating their drinking through boiling and use of chemicals, keeping their environment clean around the house and their toilets..."* (Key informant from Tandika ward on 6th April 2019).

The high level knowledge about causes of diarrhoea may be explained by diffusion of information related to diarrhoea and high rate of seeking care from health care facilities available in the area. This implies that diarrhoea is still prevalent in the informal settlements of Dar es Salaam and increasing access to water supply alone will not solve this particular problem unless sanitation and hygiene practices and their health impacts are also taken into account.

Hand washing with soap before meals ($p \leq 0.05$) was significantly associated with respondents' getting into contact with diarrhoea with an Exp(B) of 2.641 implying that respondents were two times more likely to get diarrhoea compared to chances that they were not. This may be so because, before taking a meal your hands might have been exposed to various types of infections through contaminated food and water. Those are the primary transmission routes of infectious diseases hence, increases the chances of getting into contact with diarrhoea infection if hand washing practices is poorly understood. Only this study can confirm findings of Eshete *et al.* (2015) and Abuzerr *et al,* (2019), who found that hand washing practices such before eating was significantly associated with the

risk of diarrheal disease incidence. Hand washing practices being the factor associated with diarrheal incidence indicates a significant increase in people's awareness towards WASH-related infections and their preventive measures. In the present study, educational level of mothers had a positive association with getting diarrheal disease, similar to a study in India by Paul (2020). Mothers with at least secondary education are more likely to be aware of transmission and prevention methods of diarrheal disease compared to those with no formal education. Water sources and water safety measures also had a positive association with diarrhoea incidence, similar to a study in Ethiopia (Workie *et al.,* 2019) and in Afghanistan (Nasir *et al.,* 2020), that tube wells, public taps or standpipes, springs were sources with higher chances of diarrheal morbidity among under-five children than piped water.

2.7 Conclusion and Recommendations

Based on the study findings we can conclude that generally, water is still scarce among households and treatment methods for drinking water were very disappointing. Whereas hand washing practices with soap during critical times and personal hygiene practices were low. There exists high knowledge on proper latrine utilization, WASH-related infections, and practical measures employed in the prevention of their occurrence based on the diverse responses provided. From the study, the on-going WASH-related infections in the area are positively associated with factors such as poor hand washing practices at critical times, poor treatment methods of drinking water, and the educational level of mothers. From study findings, mothers and caregivers had reasonable knowledge on causes of, and preventive measures against diarrhoea but their practices in such aspects is still questionable. Mothers and caregivers' understanding of sanitation and hygiene, water safety measures, WASH-related infections, and their prevention were not based on the level of education but on how much information they got via public health education

concerning sanitation and hygiene. The study shows significant distinction between respondents' knowledge and what they actually practice as majority are equipped with the knowledge of the things they do not practice.

The study recommends that water, sanitation, and hygiene should be treated in separate sectors and dealt with accordingly if we are to achieve the SDG 6 of ensuring availability and sustainable management of water and sanitation for all. Policy frameworks and investments should be put in place in all the sectors as insurance of people's health and better leaving conditions. The outbreak of waterborne diseases and mortality rates will continue to rise until the situation is well controlled; first people need to be aware of the importance of sanitation and hygiene before increasing access to the services.

Based on the study findings, attention must be given to expanding the availability of water in households' premises by the public water supply company accompanied with proper treatment methods before final consumption by households. In addition, it is generally recommended that integration of sanitation and hygiene behavioural change with improved access to water supply and construction of latrines is essential.

The government under the Ministry of Health and Social Welfare and Ministry of Water and Irrigation should prepare separate budgets for Water, Sanitation, and Hygiene. In addition, other private sectors should be encouraged to engage in the provision of water and sanitation services to the people as it is with health and education, which would help to cover many areas within a reasonable time.

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CHAPTER THREE

3.0 HOUSEHOLD LEVEL SANITATION PRACTICES AND THEIR IMPLICATION ON THE OCCURRENCE OF DIARRHOEA AND OTHER RELATED INFECTIONS IN TEMEKE MUNICIPALITY

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3.1 Abstract

This study aimed at assessing households' level sanitation practices and their implication on the occurrence of diarrhoea and other related infections in Temeke Municipality. A cross-sectional study was conducted in the study area involving 220 respondents, randomly selected through simple random sampling from Azimio, Mtoni and Tandika wards. The study employed a mixed-method approach involving quantitative data from the household survey and qualitative data from key informant interviews. Data were analyzed using IBM-Statistics SPSS V.20 to compute frequencies and percentages presented in tables. The findings revealed that 77.7% of all the households have latrines that can be accessed within their plot. Furthermore, 94.7% of all the households share latrines which are located near their respective compound. In addition, the majority (97.4%) of the

respondents use a bowl for washing hands, while 0.9% have a tap connected to water distribution. The majority (70%) of the respondents' latrines are in bad condition, 94% have no water available inside for flushing and cleaning the facility and 17% reported that their facility leak sometimes in the past 6 months. The study concludes that there is improper management of available latrines in the study area which is attributed to factors like overuse and water scarcity among household compounds. The study recommends that the improvement of household-level sanitation practices should be embedded with behavioural change for better utilization of available facilities.

Keywords: Sanitation, Hand-washing facilities, Diarrhoea, Improved sanitation facility, Open defecation, Informal settlement, Temeke Municipality

3.2 Introduction

The provision of safe sanitary conditions and hygiene acts as a necessary foundation of human health development and is essential to everyone regardless of their ethnicity or living standards and (Karn *et al.,* 2012). Outbreaks of communicable diseases like diarrhoea, cholera, and typhoid contribute to the increase of under-five mortality rates nearly 88% especially in developing countries specifically in highly populated areas and in informal settlements (Yimam *et al.,* 2014). They are attributed to factors such as unimproved sanitation conditions, poor hygienic measures and unsafe water supply from doubtful sources like unprotected boreholes, springs, and dug wells (Shrestha, 2017; Kumar *et al.,* 2018). Globally, about 2.3 billion people still have inadequate basic sanitation services including toilets and 3 billion people lack basic hand-washing facilities within their respective compounds and nearly a billion people practice open-air defecation (Coffey, 2013; WHO and UNICEF, 2017; Chattopadhyay *et al.,* 2019; WHO and UNICEF, 2019). It is further noticed in a study by WHO and UNICEF (2015) that open defecation is under-investigated that it has not received much attention from researchers.

Diarrhoea is one of the widely spread water-borne diseases in Sub-Saharan Africa and the under-five children is the most affected group (Kasala *et al.,* 2016). In addition, there is a link between sanitation and stunting in children through a condition called environmental enteric dysfunction causing low absorptive capacity of the digestive system (Crane *et al.,* 2015).

In Tanzania, 2 out of 10 households use improved, not shared sanitation facility which is 19% of the entire population though 86% of the rural residents use unimproved sanitation facilities and 13% still practice open defecation (MoHCDGEC *et al.,* 2016; URT, 2016; The Citizen, 2018). In addition, among the top five leading causes of childhood illness especially under-five within the country are the use of unimproved sanitation, poor hygienic practices contributing up to 12% of mortality in that age group (THDS-MIS, 2016). The Tanzanian government in an attempt to overcome the accessibility of Water, Sanitation and Hygiene infrastructures launched The National Sanitation Campaign (NSC) in 2012 (Antwi-agyei *et al.,* 2017). The aim was to increase sanitation services by increasing the number of household and schools with improved sanitation to end open defecation and poor hygienic conditions (Safari *et al.,* 2019). Furthermore, other campaigns such as *Mtu ni Afya* (To be Healthy is to be Human), *Maji ni Uhai* (Water is life) have been launched to minimize WASH-associated infections. Yet Tanzania is among the East African countries that are still lagging in meeting the Sustainable Development Goal (SDG) number 6 which is about ensuring availability and management of water and sanitation for all (UN, 2015; Mshida *et al.,* 2017). The improvement is mostly observed in urban and peri-urban areas unlike for rural residents in which more than 75% are in adverse conditions (URT, 2016).

Studies in the informal settlements of Dar es Salaam showed that the use of contaminated water and unhygienic practices such as in food preparation and disposal of excreta

increase the exposure of diarrheal disease-causing agents (URT, 2011; Sakijege *et al.*, 2012; Kyessi and Sekiete, 2015). A study done in Dar es salaam and Ifakara reported that faecal contamination levels are linked to the diminishing quality of latrine design hence an improvement in latrine design is of paramount importance in promoting sanitation (Thomas *et al.,* 2013). Sanitation conditions in Dar es Salaam city in the informal settlements such as Temeke Municipality is still poor (Kasala *et al.,* 2016; Kihupi *et al.,* 2016). About 80% of the residents reside in the informal settlements and the city sewerage system serves only about 4% of all the residents in the planned settlements (URT, 2016) like Central Business District, Kariakoo, Msasani and Ubungo Industrial area (UCLAS, 2004; Rasmussen, 2012). Also, the informal settlement dwellers classified as low-medium income earners reside in such places as in Keko Maguruwe which are in Temeke District and their major types of latrines are traditional pits covering nearly half of all the households in the area (Kasala *et al.,* 2016). These studies however have looked at the health impacts in accordance to latrine types, excreta disposal, and faecal contamination to groundwater.

The outbreak of communicable diseases in Temeke Municipality might be associated with household-level sanitation practices including the presence and conditions of such facilities. Therefore, the main objective of this study was to assess household-level sanitation practices and their implication on the occurrence of diarrhoea and other related infections in three wards of Temeke Municipality for the implementation of recommended measures against WASH-related infections. The study would help stakeholders including end-users, local government authorities, government and non-government institutions on improving health promotions regarding sanitation and hygiene. The study addresses the United Nations Sustainable Development Goals (SDGs) number 6 (UN, 2015) specifically

target 6.2 whose thrust is on ending open defecation and provide access to sanitation and hygiene.

3.3 Methodology

3.3.1 Description of the study area

The study was conducted in Temeke Municipality, Dar es Salaam region. Temeke is the industrial District of the city where the manufacturing centres (heavy and light industries) are located and the port of the city is found on the Eastern side of the area. The area was selected as it is one among the municipalities with a high concentration of low-income residents due to industry and about 70% of the area is covered with unplanned settlements with frequent environmental pollution (Van Dijk, 2014; URT, 2019). Pollution is attributed to the use of pit latrines which are in poor conditions, not connected to a septic tank, and improper disposal of solid and liquid wastes (Sakijege *et al.,* 2012; Kyessi and Sekiete, 2015).

3.3.2 Research design

A cross-sectional design was employed whereby primary data were collected at one point in time (Neuman, 2014). Quantitative data were obtained through household interviews preferably with mothers and or caregivers with the under-five children as a top priority followed by those with children below 7 years. Qualitative data were collected through key informant interviews with streets and wards representatives, and streets health officials.

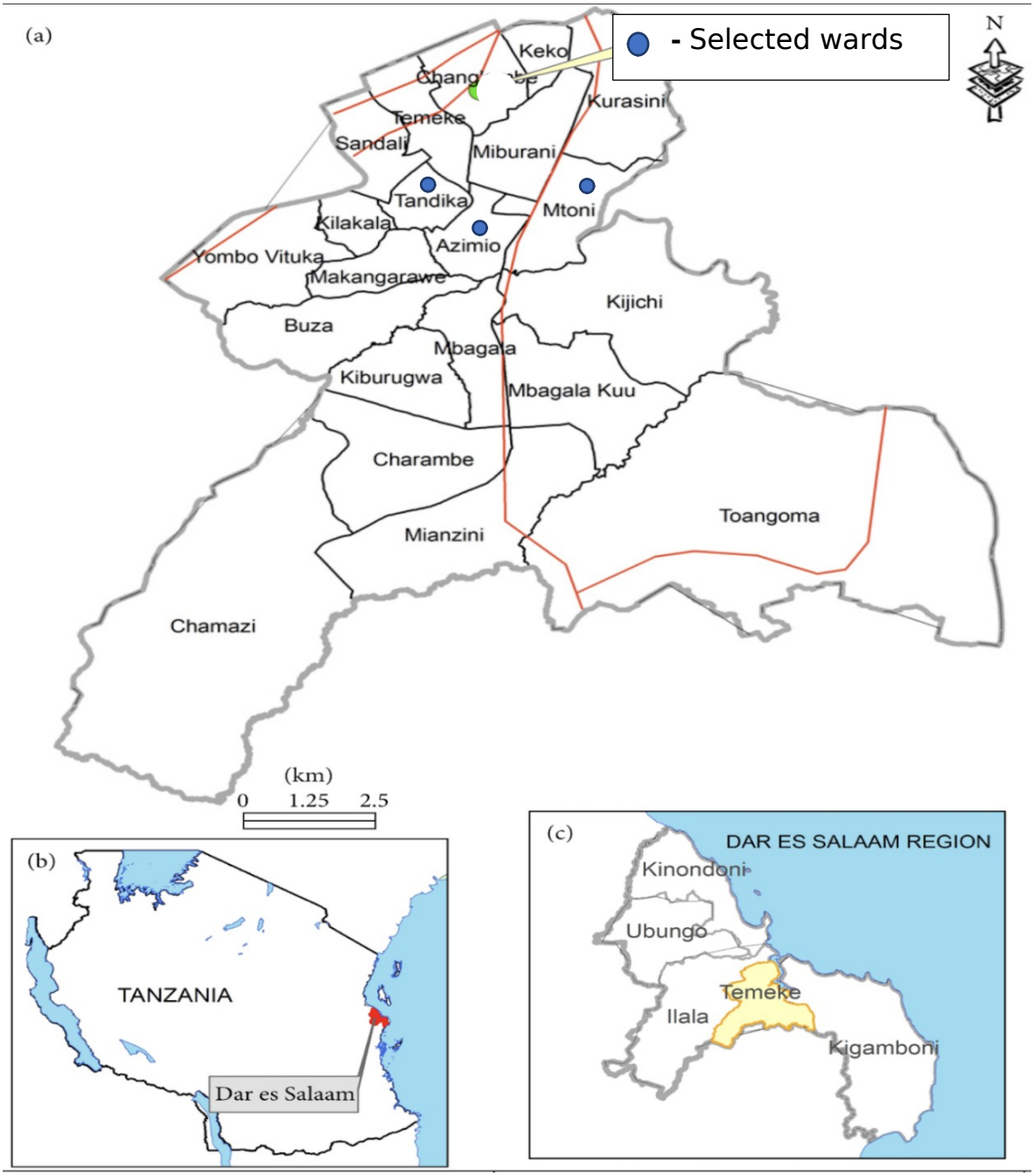

Figure 5: Map of Temeke Municipality showing selected wards

Source: Kacholi and Sahu (2018).

3.3.3 Sampling Procedure

Simple random sampling was used to select the study area and study population. The study population was mothers / caregivers with the under-five children leaving in Temeke District as they are the ones taking care of children in a family. The researcher with the help of the Temeke District Officials from the Department of Sanitation and the Environment obtained the list of 24 wards present in Temeke. A lottery method was

employed in the selection of 3 wards and 9 streets. The total sample obtained for the study was 384 mothers with under-five children who were divided in three wards obtained namely Tandika, Mtoni and Azimio. The sample was divided among the three chosen wards that are Tandika 75, Mtoni 75, and Azimio 70 making a total of 220 respondents. Due to exclusion criteria, that is mothers with children above 7 years, 164 mothers were not interviewed for the study. The sample population, which involved mothers / caregivers with the under-five children, was selected with the help of street representatives appointed by the Ward Executive Officer, as they did not have a list of households with the under-five children specifically. In every street selected, one out of five households was randomly selected for interviews and observations.

3.3.4 Data collection

Observation, key informant and household interviews, and photographs were key data collection techniques employed to capture and ensure the practices on cleanliness and latrine utilization within household compounds. Quantitative data were collected on households' sanitation practices and hand hygiene facilities in both presence and conditions. Qualitative data were collected from key informants including health officials from ward and street level, and ward executive officers.

3.3.5 Data Analysis

The data collected were analysed using IBM-Statistics SPSS windows version 20.0. Descriptive analysis was employed to analyse the household level sanitation practices and hand washing facilities and presented in frequency tables. Content analysis was employed to analyse qualitative data collected from key informants.

3.4 Findings

3.4.1 Socio demographic features of respondents

Out of 220 respondents, 16% were within the age range of 18-25 years, 32.7% were within the range of 26-33 years, 26% were within the range of 34-40 years. Furthermore, 67% were married with an average family size of 4 and more people and the majority (92.3%) were having under-five children. The majority (72%) had basic education, 23% completed secondary school. The majority 87.3% were self-employed engaged in small businesses such as a kiosk, selling bites and fried fish just outside their houses, tailoring, and selling ice creams (Table 7).

Table 7: Socio-demographic Information of Respondents (n=220)

Variable	Category	Frequency	% (%)
Age (in complete years)	18 – 25	37	16
	26 - 33	75	32.7
	34 – 40	58	26.4
	41 and above	50	21.5
	Total	**220**	**100**
Marital status	Married	147	67
	Single	39	16.9
	Engaged	34	14.8
	Total	**220**	**100**
Educational level	Primary level	158	72.0
	Secondary level	53	23.0
	Tertiary level	1	0.4
	No formal education	8	3.5
	Total	**220**	**100**
Household size	< 5 years	203	92.3
	No > 5 children	17	7.0
	Total	**220**	**100**
	> 5 years and adults	220	100
	Total	**220**	**100**
Income-generating activity	Self-employed	196	87.3
	Casual labor	16	6.9
	Official employment	2	0.9
	Housewife	6	2.6
	Total	**220**	**100**

3.4.2 Household-level sanitation practice and hand hygiene facilities

Household-level sanitation practices and hand hygiene facilities were assessed through self-reporting and the observation of proxy indicators that focus on the existence of latrine facility and hand washing points which also involved photographs. Available latrines within the interviewed households were for single household and others shared. Only 10.7% of the available latrines were owned by single households while 94.7% were shared by several households. In addition, the most common type of latrine used was pour-flush without water seal linked to a pit for both owned by single households (9.3%) and shared (57.3%) (Table 8). Furthermore, the majority (77.7%) of the households have only one accessible latrine within their compound, 20% had two latrines available for use. Out of 220 households, 6-10 households (55%) share the same latrine followed by 11-15 households (21.3%) and during the day the number of people using the latrine ranged from 6-10 (Table 9). In Table 10, 72.7% of all the latrines were observed to be in bad condition, only 26% were satisfactory. Only 6.4% of the available latrines had water for flushing inside the facility. In addition, 6.4% of all the observed latrines were not in use and the major reason suggested include the latrines were full. Some latrines' conditions were unfavourable in that 17% of the respondents reported that their latrines were leaking sometimes in the past six months. Of all the available latrines, 41.3% latrines were reported to have never been emptied.

Table 8: Accessibility and latrine type for use by the household (n=220)

Category	Variable	Azimio (n = 70)		Mtoni (n = 75)		Tandika (n = 75)	
		Freq.	Per. (%)	Freq.	Per. (%)	Freq.	Per. (%)
Availability of latrine	Privately owned	6	7.5	7	9.3	8	10.7
	Shared latrines	70	100	71	94.7	71	94.7
Latrine type (non-shared)	Pour-flush toilets	2	2.5	4	5.3	7	9.3
	VIP latrine	-	-	2	2.7	-	-
	Pit latrines	4	5	-	-	1	1.3
Latrine type (shared)	Pour-flush linked to sewer	-	-	2	2.7	-	-
	Pour-flush toilets	13	16.3	9	12	5	6.7
	Dry toilets	29	36.3	49	65.3	43	57.3
	Pit latrines	38	47.6	10	13.3	1	1.3

a) b)

Figure 6: Latrine types available; a) Open pit b) Dry pit

Table 9: Households' latrine utilization (n=220)

Category	Variable	Azimio (n = 70)		Mtoni (n = 75)		Tandika (n = 75)	
		Freq.	**Per. (%)**	**Freq.**	**Per. (%)**	**Freq.**	**Per. (%)**
No. of available latrines	1	52	77.5	60	80.0	59	78.7
	2	16	20.0	14	18.7	14	18.7
	3	1	1.3	-	-	2	2.7
	4	1	1.3	1	1.3	-	-
	Total	**70**	**100**	**75**	**100**	**75**	**100**
Household using same latrine	1-5	8	10	15	20	10	13.3
	6-10	37	58.7	41	54.7	43	57.3
	11-15	19	23.8	14	18.6	16	21.3
	>16	6	7.5	5	6.7	6	8
	Total	**70**	**100**	**75**	**100**	**75**	**100**
No. of people using the latrine daily	1-5	18	35.0	33	44.0	24	32.0
	6-10	29	36.3	26	34.7	31	41.3
	11-15	18	22.5	11	14.7	17	22.7
	>16	5	6.3	5	6.7	3	4.0
	Total	**70**	**100**	**75**	**100**	**75**	**100**

Table 10: Latrine condition and pit emptying (n=220)

Category	Variable	Azimio (n = 70)		Mtoni (n = 75)		Tandika (n = 75)		Total (n=220)	
		Freq.	Per. (%)	Freq.	Per. (%)	Freq.	Per. (%)	Freq.	Per. (%)
Latrine cleanliness	Clean	14	17.5	33	44	13	17.3	**60**	**26**
	Not clean	56	82.5	42	56	62	82.7	**160**	**72.7**
Water availability	Available	-	-	9	12	5	6.7	**14**	**6**
	Not available	70	100	66	88	70	93.3	**216**	**94**
Currently in use	Latrine is in use	56	82.5	75	100	75	100	**216**	**94**
	Latrine is not in use	14	17.5	-	-	-	-	**14**	**6**
Reasons for not in use	Full	14	17.5	-	-	-	-	**14**	**6**
Leakage	No, never	42	65.0	57	76.0	52	69.3	**161**	**70**
	Yes, sometimes	8	10.0	12	16.0	19	25.3	**39**	**17**
	Yes, frequently	2	2.5	1	1.3	-	-	**3**	**1.3**
	Don't know	18	22.5	5	6.7	4	5.3	**27**	**11.7**
Pit emptying	Yes, emptied	46	70	55	73.3	24	32	**135**	**58.7**
	No, never emptied	24	30	20	26.7	51	68	**95**	**41.3**

Figure 7: Leakage in a sanitation facility

3.4.3 Presence and type of hand-washing facilities

Table 11 describes the kind, location, functionality and soap availability for the hand washing facilities owned by the respondents. Based on the results, at least the respondents from Mtoni and Tandika had a hand washing facility within their compounds. For those having actual facilities, the findings indicates that 6.7% of the respondents from Mtoni and 1.3% from Tandika were tap connected to water distribution because of how the house was designed as it was for a single household, unlike others where they were all tenants. The findings indicates that, 4% of the hand washing facilities from Mtoni were located inside the house, 2.7% were located outside the house and from Tandika 1.3% they were located inside the house. The available facilities were all functional but only 1.3% were equipped with essentials like soap.

Table 11: Kind, location, functionality and soap availability for the hand-washing facility (n=220)

Variable	Category	Azimio (n = 70)		Mtoni (n = 75)		Tandika (n = 75)		Total (n=220)	
		Freq.	**Per. (%)**	**Freq.**	**Per. (%)**	**Freq.**	**Per. (%)**	**Freq.**	**Per. (%)**
Kind	Bowl of water	70	100	70	93.3	74	98.7	**214**	**97.3**
	Tap connected to water distribution	-	-	5	6.7	1	1.3	**6**	**2.6**
	Don't have a hand-washing facility	70	100	70	93.3	74	98.7	**224**	**97.3**
Location	Inside the house	-	-	3	4	1	1.3	**4**	**1.7**
	Outside the house	-	-	2	2.7	-	-	**2**	**0.9**
	Don't have a hand-washing facility	70	100	70	93.3	74	98.7	**224**	**97.3**
Functionality	Yes, right next to the latrine	-	-	3	4	1	1.3	**4**	**1.7**
	Yes, within 10m	-	-	2	2.7	-	-	**2**	**0.9**
Soap availability	Available	-	-	2	2.7	1	1.3	**3**	**1.3**
	Not available	70	100	73	97.3	74	98.7	**227**	**98.6**

3.5 Discussion

The study found that, majority of the latrines were shared with more than one household. Based on Joint Monitoring Program reports from WHO and UNICEF, latrines must be used by only one household. This is in contrast with WHO reports that 19% of the population in Sub-Saharan Africa depend on shared latrines (WHO and UNICEF, 2019). Similar findings are reported in a study done in Kenya that households' sanitation facilities were pit latrines which were shared, not clean hygienically, and inadequately managed (Simiyu *et al.,* 2017). This similarity might be attributed to the nature of the study areas selected. These findings imply that it is a common practice for the informal settlement dwellers to share latrine facilities with a significant number of households without taking into consideration the health impacts of such practice. This indicates that latrine conditions within the area might be associated with the number of households sharing them which expose the users to faecal contamination resulting in infections such as diarrhoea, typhoid through the faecal-oral route. Similarly, a study by Günther *et al.* (2012) and WHO (2014) found that there is a negative association between the number of households using a latrine with its cleanliness and positively associated with infections related to faecal contamination.

The most common type of latrines used in the study area were dry toilets. Similarly, a study done in Arusha reported that two-thirds of the available latrines were traditional pits (Mshida *et al.,* 2017). This similarity might be attributed to the nature of the study areas and the socio-economic status of the study population. Financial constraints of the residents and inadequate water supply systems make them unable to afford the costs of constructing a VIP latrine hence dry latrines remain the common latrine types used in many places especially in slums. These findings imply that in Temeke Municipality more than three quarter still use unimproved pit latrines whereby the majority are in bad shape

making the area more prone to the outbreak of communicable diseases, in particular diarrhoea.

In the present study, some shared latrines were not in use because they were full possibly due to the high water table and pit emptying practices. These findings imply that pit emptying costs together with little understanding of the benefits of a well-managed sanitation facility might be contributing factors for some of the latrines around the area to be full. Some respondents said that latrine maintenance and cleanliness is not their responsibility rather that is up to their landlord. These findings can also be reflected from the study done in Dar es Salaam about pit emptying behaviours which reported that latrine facilities in landlord-tenant mixed houses were less likely to be functional and of poor quality (Jenkins *et al.,* 2015). In informal settlements, the majorities are tenants residing in tenant-only houses or landlord-tenant mixed houses. It is a tendency that when pits are full, the landlord is responsible for finding an available pit emptying agent and incurs the costs. So for that case, when the landlord is unaware of the danger caused by excreta to human health, the effects can be significant resulting to the outbreak of infectious diseases in particular hepatitis, cholera and others. Improper waste and excreta management have been implicated in the transmission of human excreta-transmitted diseases which predominantly affect children and the poor as one of the participant from Mtoni ward had this to say,

> *"...In our community, the majority are tenants mostly living in tenant-mixed houses with medium income levels and based on the design of tenant houses in our area, latrine facilities are to be shared by all the tenants. Regardless of the locally available pit emptying agents, some of the pits used by the residents are full for quite some times and they all depend on their landlord to do the emptying. When this condition prevails, it endangers children's health like the under-fives who*

need closer look in their daily playing...” (Key informant respondent from Mtoni ward 9th April 2021).

Most of the available latrines were observed to be in bad condition with bad smell and some with the presence of insects. These findings are in line with a study done in Dar es Salaam city that there are people who have poor toilets that are extremely risky to users and the environment in general (Kasala *et al.,* 2016). Inadequate sanitation has been linked to several health risks such as stunting, schistosomiasis, trachoma apart from diarrhoea (Crane *et al.,* 2015). From the study findings, it is not yet clear about the intentions of cleaning shared latrines and users' satisfaction levels of such facilities. Similarly, a study done in an urban slum of Uganda reported that the cleanliness of shared latrines was dependent on users' cleaning frequency and cooperation (Tumwebaze and Mosler, 2013). Based on study findings, it is evident that shared latrine facilities are in the outbreak of future malfunctioning due to poor design, intensive use, and maintenance of the facility itself. Renting houses in Dar es Salaam seems to be more business-oriented leaving behind the well-being and health aspects of the end-users resulting in the risk of disease outbreak. In the present study, latrine cleanliness was observed to be very poor possibly because of water scarcity as the practice requires a significant amount of water and willingness of users to clean. This emphasises the need for hygiene education and latrine management. Furthermore, studies by Sara and Graham (2014) and Jenkins *et al.* (2014) linked to access to improved sanitation and socio-economic statuses such as income levels and educational status. Rich and educated people living in informal settlements are more likely to have access to safe, improved and functioning sanitation facilities compared to low-income earners. Moreover, some studies reveal an association between the quality of latrine construction and its cleanliness (Diallo *et al.,* 2007; Irish *et al.,* 2013). This can be linked with findings in the present study that latrines were of poor quality, very old and in some

places especially in Azimio and Mtoni latrines were missing a superstructure and some a door. The majority of the respondents were medium to low-income earners merely having access to only the necessities of life hence access to safe and improved sanitation is still a problem. This can be confirmed by a key informant from Azimio ward, who said,

> *"...Our ward (Azimio) is mixed with high and low income earners so even their residents differ in design and appearance. You would find a clean and well-constructed sanitation facility inside a rich house whether inside or outside the house in a single compound unlike for low-income earners. Latrines in poor families are not well constructed, managed, and are intensively shared by many households causing it to diminish early..."* (Key informant respondent from Azimio ward 6th April 2021).

Furthermore, the study revealed that some latrines have never been emptied. This can be related to the economic status of the household head or the landlord. This is because emptying services are expensive and the majority are low-medium income earners which could lead to latrines being full hence not in use for a while. Similar findings were observed in a study by Chaggu *et al.* (2002) that due to financial constraints and the lack of space for the adoption of other options, pit latrines in majority of the households are not in use and in bad conditions. Similar findings were seen in a study done in the slums of Dar es Salaam that the costs for pit emptying services can range from 70 000 - 110 000 TZS depending on the type of technology used. In the case of manually putting faeces in another pit, it cost between 50 000 - 70 000 TZS but emptying with a service motorcycle with a 50-litre tank costs 70 000 TZS. While, a truck with a vacuum tank of 20,000 litres would cost around 100 000 - 120 000 TZS (Mwalwega 2010; Van Dijk, 2014). The respondents reported leakage or overflowing of some latrines at some points in time in their daily use. This could lead to contamination of domestic water sources and storage

facilities accounting for the spread of communicable diseases. The possible explanation for that is, pit latrines lack a physical barrier, such as concrete, between stored excreta and groundwater hence when the pit is filled with too much water the excess water would find a way of escaping as the facility will no longer be able to hold it. This is in contrast with the study done in Dar es Salaam city about Faecal contamination of drinking water caused by poorly managed pits around the area (Kihupi *et al.*, 2016).

> *"...In our community, the most common types of latrines are dry and open pits due to construction and pit emptying costs. That is so because majority cannot afford hiring a truck with a vacuum for emptying due to location problems and embedded costs for the services hence forced to call for manual emptying which costs a bit lower than the trucks..."* (Key informant respondent from Tandika ward 6th April 2021).

In the present study, more than three-quarters of the respondents' households (97.4%) did not have a hand-washing facility located anywhere within their compounds or near sanitation facilities. Very few possess a hand washing facility located either right next to the latrine or in a nearby location within 10 metres and they were functional. These findings reflect those from a study by Mwakitalima *et al.* (2018) that two-thirds (65%) of the households were found to have no specific places for hand washing with soap. A study by Thiam *et al.* (2019) revealed that poor hygienic measures are the predominant cause of diarrheal infections among household members specifically the under-fives. It shows that hand washing facilities is not much of a concern when it comes to hygiene and people are used to constructing latrines without considering a specific place to wash hands (a sink perhaps) during the design. The few available hand washing facilities had soap and water available indicating that hand hygiene in the surveyed area is still low. Water availability

and sanitation are the most considered aspects related to WASH while forgetting that hand hygiene also impacts health when mistreated.

3.6 Conclusion and Recommendations

Based on findings from the study we can conclude that generally, latrine quality and conditions was poor, far behind the 95% as promised by the government in The Tanzania Development Vision (2025). The latrines were unimproved based on the criteria provided by WHO and UNICEF concerning the safety and management of sanitation facilities within household compounds. Pit emptying behaviour is still not considered essential; the respondents think that it is not one of their responsibilities while the side effects would impact them all. From the study we can conclude that safe sanitation and hand hygiene were influenced by socio-economic and contextual factors such as educational levels (literacy) as the majority had basic education; income as the majority were low and medium-income earners, area of residence as they were residing in informal settlements. Concerning hand washing facilities, respondents are not aware that they are supposed to have a specific place to wash their hands like after visiting the toilet indicating low hand hygiene knowledge. Respondents are aware of the possible outcomes of poor sanitation and hygiene and some of the communicable diseases and their possible preventive measures.

The study recommends that sanitation and hygiene projects in the city should consider the construction of improved latrine facilities which safely and hygienically separate excreta from coming into contact with a human, a bathing place, and a specific place to wash hands near latrines.

Efforts made by the government or NGOs to improve sanitation conditions need to consider initiatives beyond the construction of improved toilets such as effective solid and

liquid waste management. The application of different excreta disposal system is possible in Dar es Salaam due to the complexity of the city.

Emphasis on the importance of using environmentally friendly pit emptying services to minimize further consequences caused by unsafely handling of faecal materials.

Better strategies on understanding what influences latrine cleanliness and hand hygiene behaviours for better planning of interventions including psycho-social, contextual and behavioural change techniques and proper ways of handling the sludge and re-use the material if possible.

Emphasis on the importance of having hand washing facilities together with soap available for washing hands during critical times as this was the least considered practice. Awareness of the importance of having hand washing facilities should be of paramount importance just like having latrines. Construction of facilities should be near toilets to avoid inconveniences caused by a distant facility.

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CHAPTER FOUR

4.1 Summary of major findings

Below is a summary of the study's major findings in a chronological order as per presented manuscripts.

4.1.1 Knowledge and Practices towards Water, Sanitation, Hygiene and Water-borne diseases

Objective one was about examining peoples' awareness and attitude towards WASH and associated infections. Whereas, objective two was concerned about evaluating practices on water (use and management) in relation to sanitation and hygiene. Generally, the findings from the study revealed that hand washing practices during critical times is still low in the area as majority do not consider the importance of the practice though some are aware of the benefits of doing so. The use of soap in washing hands was practiced by few (22.6%) which was before taking a meal and 45.2% after taking a meal. Respondents were aware about good sanitation practice and agreed to the fact that construction of better quality and proper utilization of latrine facilities may have an impact in reducing the incidence of waterborne diseases. When it comes to personal hygiene activities, ironing and hand washing was rarely practiced which indicates that hand washing is a problem. Majority of the respondents (60.8%) were aware about the importance of having a well-constructed latrine (good design, high quality) together with good maintenance in minimizing the incidence of some communicable diseases. Among the good sanitation practice practiced by the respondents was the disposal of child faeces by throwing them into the latrine (72%) while for children above 5 years were allowed to use the latrine. Water sources for majority of the respondents were public tap/ standpipe (40%) and public water kiosk (36.9%) suggesting that water is still a problem. That resulted into respondents not considering uses of water such as for cleaning the latrine facilities, hand washing as part of

their daily water use. Binary logistic regression model was done to find out factors associated with household members contacting diarrhoea. Hand washing with soap before meals ($p \leq 0.05$) was significantly associated with respondents' getting into contact with diarrhoea with an Exp(B) of 2.641 implying that respondents were two times more likely to get diarrhoea compared to chances that they were not. This may be so because, before taking a meal the hands might have been exposed to various types of infections through contaminated food and water which are the primary transmission routes of infectious diseases. Hence, increase the chances of getting into contact with diarrhoea infection if hand washing practices is poorly understood.

In addition, findings from the study shows that respondents have some ideas of what sanitation and hygiene are about but their attitude towards the practice is an issue as they do not practice what they know rather they do so because they have seen others doing the same.

4.1.2 Household Level Sanitation practices and its implication on occurrence of diarrhoea and other related infections in Temeke Municipality

Objective three was mainly concerned about examining the presence and conditions of existing sanitation and hand washing facilities in the area. Study results indicates that, when it comes to actual facilities this is where real problems are as some facilities are too old and to some extent dangerous for the user like the latrine facilities. About hand washing facilities, only 1.3% of all the respondents possess such facilities within their respective compounds. The most common latrine types as portrayed by study findings are the pour flush without water seal linked to pit (57.3%) but the problem arises when it comes to water availability within a latrine in which only 6% of all the availability reported to have water inside either it's a tap connected to water distribution or a bucket of water which is frequently refilled with water. Another surprising thing based on study

findings is the use of those available latrines, one latrine is shared by up to 10 households (57.3%), sometimes more than 11 households depends on one latrine for their daily use (21.3%). The resulting effect of that practice is seen in the management of the latrine itself as some (17%) reports to be leaking at some point in time, while others (1.3%) reported to be leaking frequently.

Furthermore, taking into account conditions of available latrines in the study area you can depict that those people are at higher risk of getting into contact with some communicable diseases if the situation will not be corrected in the next years to come. Good quality latrines, pit emptying behaviors and overall maintenance of the latrine facility is essential in assuring that users are not at risk when it comes to their health.

4.2 Conclusions

Hand hygiene practices within a household is merely a common practice that people are used and not because they aware of its importance. That can be explained by observing their hand washing behaviors especially during critical times like before preparing food, after feeding the children and after visiting the toilet. All that can be attributed by the lack of hand washing facilities within their compound which will at least trigger their hand washing behaviors and perhaps understand the importance of the practice.

Respondents are aware of the importance of having a standard and well managed latrine facility but looking at their actual facilities they are using it’s quite the opposite. Their facilities are in bad shape mostly, some with broken doors, some with no superstructures plus they are not clean most of the time as almost all of them do not have water in the inside. Latrine maintenance is still a problem as almost all of the facilities need renovation because they seem old and not good looking, some are leaking which pose threat to users health wise.

Based on the nature of the latrine facilities available, the disposal of child stool is mostly by throwing into the toilet which is not ideal for the pit itself based on what is said by those people dealing with pit emptying services as it damages the pit time after time. Private water suppliers became the sole suppliers of water around the area as majority depend on them. This can also be linked with the personal hygiene activities done by the respondents as majority opt for those which are a bit necessary like bathing and washing clothes as the activities require significant amount of water which they do not have. When it comes to water treatment, the majority do not treat water at the point of use as they are used to them and some say water tastes way better when you do not treat it and for those treating drinking water, boiling is their best option.

About communicable diseases ever occurred in the area, respondents are of diarrhoea and cholera as the common ones. They also happen to know some of the preventive measures of each disease and the consequences of not keeping the environment clean. In addition, they have a routine service of garbage collection in every week which is a contract by the city engineers and the government though the service is not adequate in all places as some were saying even a month can pass without seeing those trucks for collecting garbage passing in their streets.

4.3 Recommendations

Incorporation of both sanitation and hygiene infrastructures and awareness services as we have seen that respondents know some aspects of improved sanitation and hygiene practices but they lack supportive infrastructures to do so hence ending up practicing those which are possible at the moment. Sanitation programs should focus on the needs of specific groups within the society like elders, women and children by making sure they not only improve their infrastructures but also provide some education on proper uses and management if such facilities for sustainable development.

It is highly recommended that the government should treat water, sanitation and hygiene as separate sectors when it comes to understanding the specific needs of each as most of the time their effects to human health are combined. At most times, the established projects mainly focus on water supply seeing that as a corner stone for improving WASH which is not the case. Taking an example of a leaking latrine facility near a water body whereby the water discharged from the facility will penetrate and enter into the water body in which people use for various domestic purposes like cooking and drinking hence having a combined effect of doubtful water source, poor sanitary conditions and hand hygiene practices.

The government through the Ministry of Health should focus more on sanitation and hygiene as it directly affects people in many ways. Having a separate budget that covers all issues of sanitation and hygiene within the country, policy frameworks and encouraging other private sectors to involve themselves in providing sanitation and hygiene services which would save the governments' time and money by not doing everything on their own.

Support to local government official and their local initiatives within the wards that mainly focus on specific needs of each sector as they are the first to understand what is really happening within their communities. Access to loans by NGOs and other private entities should be made easy for them to be able to construct separate facilities like hand washing facility, a bathing place, and toilets as it was observed earlier in discussion that almost all respondents use latrine for bathing with no specific place to wash hands.

Water sector needs to reconsider city development and the understanding of water and sanitation and come up with innovative strategies which will consider both piped

provision and possible solutions to water provision as well as discharge. As it was explained in the second paper, the city's drainage system only covers 4% of all the areas while other areas are in high demand of well-designed drainage systems especially in urban slums.

4.4 Area for further study

The cross-sectional nature of the study was mainly focusing on possible trigger points of the communicable diseases among the respondents. Another study is expected to go deep into causal relationship adopting a longitudinal design and compatible statistical analyses. In addition, the current study focuses on knowledge, attitude and practices towards WASH as possible causes of communicable diseases like diarrhoea, so the future study should go deep and look into cause-effect relationship to get clear results. Further studies in aspects related to effects of pit latrines on groundwater around the city are also recommended.

APPENDICES

Appendix 1: Questionnaire for Mothers / Caregivers

SECTION A: SOCIO- DEMOGRAPHIC CHARACTERISTICS OF RESPONDENT

A1. What is your name? Write single name (Optional)	Name in capital letter	_____
A2. Age *(In complete years)*	1. 15-25	
	2. 26-36	
	3. 37-47	
	4. 48 and above	
A3. Marital status	1. Single	
	2. Married	
	3. Cohabiting	
	4. Divorced	
	5. Widowed	
	6. Separated	
A4. Education Level	1. Tertiary level (college)	
	2. Primary level	
	3. Secondary level	
	4. No formal education attended	
A5. How many people does your family have?	1. Children under 5 years	_____
	2. Children above 5 years and adults	_____
	3. Total	_____
A6. Occupation/any Income Generating Activity	1. Official employment	
	2. Farming	
	3. Casual labor	
	4. Business (specify)	
	5. Other (specify)	

SECTION B: WATER USE AND MANAGEMENT IN RELATION TO SANITATION

AND HYGIENE (put a tick where applicable)

B1: Main source of drinking water for household use

	Primary	**Secondary**
1. Piped into the house		
2. Recently constructed water kiosk		
3. Piped to yard or plot		
4. Public tap/standpipe		
5. Rainwater collection		
6. Bottled water/gallon container and dispenser		
7. Tanker-truck/cart with small tank/drum (small scale water vendors)		
8. Others (please specify)		
multiple response is possible		

B2: Main source of water for other purposes like cooking, washing and other domestic uses

	Primary	**Secondary**
1. Piped into the house		
2. Recently constructed water kiosk		
3. Piped to yard or plot		
4. Public tap/standpipe		
5. Rainwater collection		
6. Bottled water/gallon container and dispenser		
7. Tanker-truck/cart with small tank/drum (small scale water vendors)		
8. Others (please specify)		
multiple response is possible		

B3: Who usually goes to this source to fetch water for your household?

1. Adult women (>15 years)	
2. Adult men (>15 years)	
3. Boys (<15 years)	
4. Girls (<15 years)	
5. Delivered by vendor	
multiple response is possible	

B4: If depend on water vendor, what type of water vendor do you use?

1. Bicycle vendors	
2. Donkey vendors	
3. Vendor using cats	
4. Water bowser (tanker)	
5. Others (please specify)	
multiple response is possible	

B5: What's your family's daily water consumption?

1. Rainy season _____ **2.** Dry season _____

B6: What measure(s) does this household take to ensure the safety of drinking water?

1. Boil	

2. Let water settle	
3. Use water filter	
4. Filtering with a cloth	
5. Sand/ ceramic filter	
6. Chemicals (e.g. Water guard/ aqua tab)	
7. Bottled water	
8. Others (specify)	
multiple response is possible	

B7: What kind of water storage facility does the household use?

1. Traditional clay pot with a lid	
2. Traditional clay pot without a lid	
3. Bucket with a lid	
4. Bucket without a lid	
5. Jerry can with a lid	
6. Jerry can without a lid	
7. Bucket/container with a tap	
multiple response is possible	

B8: Which use of water do you have more challenges with currently?

Main use of water source	**Currently**
1. For drinking and cooking	
2. Washing self/bathing	
3. Washing clothes	
4. For sanitation facilities cleaning	
5. For hand washing after use of toilet	
6. Others (specify)	
multiple response is possible	

B9: The last time [name of youngest child] passed stools, what was done to dispose of the stools?

1. Child used toilet/ latrine	
2. Put/rinsed into toilet or latrine	
3. Put/rinsed into drain or ditch	
4. Thrown into garbage	
5. Buried	
6. Left in the open	
7. Other (specify)	
8. Don't know	

B10: What is the most common waterborne disease in this area?

1. Diarrhea	
2. Cholera	
3. Typhoid	
4. Amoeba	

B11: In case of water-borne disease outbreak in your area, which group is mostly affected?

1. Children < 5 years	

2. Children > 5 years	
3. Youth (18-35) years	
4. Elders > 40 years	

B12: What health facility does your household use most?

1. Government facility	
2. Private facility	
3. Religious/ NGO/ CBO facility	
4. Traditional healer	

SECTION C: PRESENCE AND CONDITIONS OF EXISTING SANITATION AND HAND-WASHING FACILITIES

C1: Is there at least one latrine accessible for the household at the plot?
(Interviewer please ask for both (a) and (b))

A. Household		**B. Shared**	
1. Yes		1. Yes	
2. No		2. No	

C2: What kind of latrine is this?
(Answer both for (a) and (b) if applicable)

A. Household		**B. Shared**	
1. Pour flush linked to sewer line		1. Pour flush linked to sewer line	
2. Pour flush linked to septic system		2. Pour flush linked to septic system	
3. Pour flush with water seal linked to pit		3. Pour flush with water seal linked to pit	
4. Pour flush without water seal linked to a pit		4. Pour flush without water seal linked to a pit	
5. VIP latrine		5. VIP latrine	
6. Traditional pit latrine with slab		6. Traditional pit latrine with slab	
7. Traditional pit latrine without slab		7. Traditional pit latrine without slab	
8. Eco-san		8. Eco-san	
9. Bucket		9. Bucket	
10. No toilet facility		10. No toilet facility	
11. Others (specify)		11. Others (specify)	

C3: Is the pit lined?
1. Yes _____ 2. No _____ 3. Don't know _____

C4: Can I see your household or shared latrine?
1. Yes _____ *(Data collector please ask for permission and take a picture)*
2. No _____

C5a: Is your toilet functional or currently in use?
1. Yes _____ 2. No _____

C5a: If the toilet is not functional or currently in use, why?

1. Dirty	
2. Full	
3. No water to wash	
4. Slab broken	
5. Superstructure missing or broken	
6. Building not finished	
7. Used as storage	
8. Smells bad	
9. Others (specify	

C7a: ***Observation***
Is the HH latrine lined or not lined?
1. Yes _____ *(Data collector please ask for permission to observe and take picture if the HH pit latrine is lined?)*
2. No _____

C7b: Is the latrine clean?
1. Yes _____ 2. No _____

C8: Is water available for washing and flushing?
1. Yes ____ No ____

C9: How many latrines are there in this plot?
_____ Number of latrines

C10: How many of these latrines are currently in use?
_____ Number of functional latrines

C11: How many households in total are using the same latrine that your household is using?
_____ Number of Households

C12: How many people use this latrine on a daily basis?

1. 1 - 5	
2. 6 -10	
3. 11 - 15	
4. More than 15	

C13a: Is there anyone in this household who does not regularly use the latrine?
1. Yes ____
2. No ____ (If no, go to **C14**)

C13b: If yes, who does not regularly use the latrine?

1. Children from 2 years to less than 5 years	
2. Children from 5 to 10 years	
3. Female adults	
4. Male adults	
5. Disabled	
6. Others	

multiple response is possible	

C14: Has the pit latrine ever been emptied?
1. Yes _____ 2. No ____

C15: Does your sanitation facility leak or overflow wastes at any time of the year?

1. No, never	
2. Yes, sometimes	
3. Yes, frequently	
4. Don't know	

C16: How does your household usually dispose of garbage?

1. Collected by formal service provider	
2. Disposed of within household yard or plot	
3. Buried or burned	
4. Disposed of elsewhere	

C17: How do you dispose of household water used for laundry (children clothes)?

1. Sink/drain connected to open drain or open ground	
2. Disposed directly to open ground or water body	
3. others (specify)	

C18: How do you dispose water used for cleaning the children (bathing)

1. Sink/drain connected to open drain or open ground	
2. Disposed directly to open ground or water body	
3. others (specify)	

SECTION D: PEOPLES' AWARENESS AND ATTITUDE TOWARDS WASH
D1a: Do you think it is important to wash your hands after visiting the toilet?

1. Yes ____ 2. No ____ 3. Don't know ____ 4. Others (specify) _____
D1b: If yes, what is the main reason why?

1. To prevent transmission of diseases	
2. To prevent the contamination of food	
3. To clean them (hands)	
4. It's a cultural/ religious practice	
5. It's tradition/ common practice	
6. Other (specify)	
multiple response is possible	

D1c: If no, what is the main reason why?

1. Washing hands does not stop transmission of diseases	
2. Washing hands is not good	
3. It's wastage of water	
4. Don't know why hand washing is important	
5. Other (specify)	
6. Non-applicable	
multiple response is possible	

D2: Do you wash your hands before and after meals?

		Before	After	**B**	**A**
B: Before		1. Yes	1. Yes		
A: After		2. No	2. No		

		Before	After	**B**	**A**
B: Before		1. Yes	1. Yes		
A: After		2. No	2. No		

D3: Do you use soap when washing your hands before and after meals?

D4: Why do you wash your hands with soap before meals?
Please explain _____

D5: Why do you wash your hands with soap before meals?
Please explain _____

D6: Do you think you will encourage your family members and friends to wash their hands with soap frequently?
1. Yes (please explain) _____
2. No (please explain) _____

D7: Do you feel like it is troublesome washing your hands with soap?
1. Yes (please explain) _____
2. No (please explain) _____

D8: What do you use for your personal hygiene (anal cleansing method used)

1. Water	
2. Old paper sheets	
3. Toilet paper	
4. Newspapers	
5. Old (cement) bags	
6. A combination (water and paper)	
7. Leaves	
8. Sand/stone	
9. Hands	
10. Nothing	
11. Others	
12. Don't know	

D9: Has any member of your family ever contracted diarrhea in the last six months?
1. Yes ____ 2. No ____

D10: When did your area last experience diarrhea/ cholera outbreak?

1. Over two years ago	
2. Past two years	
3. Last year	
4. Last six months	
5. Last month	
6. The area report cholera suspects at the moment	
7. Do not remember	
(The information should be confirmed at the local government office)	

D10: What kind of hand-washing facility do you have?

1. Bowl of water	
2. Tap connected to water distribution	
3. Tippy tap	
4. Container with tap	
5. Others (specify)	
6. Don't have a hand-washing facility	
7. Don't know	

D11: Where is your hand-washing facility located?

1. Inside the house
2. Outside the house
3. Inside the toilet
4. Outside the toilet

Thank you for your corporation

Appendix 2: Key Informant Interview Guide

Water supply

1. From where are water supplies currently being collected?
(Note also the origin i.e. groundwater, surface water, rainwater)
2. Who owns these water sources?
3. What is the physical condition of these water sources?
4. Are the water sources protected from contamination?
5. Is water available all day?
6. Are water supplies chlorinated?
7. What do you think about the quality of the water i.e. taste, smell, color, contamination?
8. Do people practice any form of household water treatment?
(boiling, filtering, chlorination, disinfection)
9. What do you feel are the biggest public health risks related to water supply?
10. What do you feel needs to be done to improve these water sources?

Excreta management

1. Are existing toilet facilities being operated successfully? Can they be adapted, improved or extended?
2. Do you like the design of the toilet facilities? Is it culturally acceptable? Comfortable? Safe to use?
3. Are people familiar with the design and construction of toilets?
4. Do you think the toilet design is generally acceptable to all users in particular children, the elderly, disabled users?
5. How and where are children's faeces disposed?
6. What do you think are the solutions?

Protection of users at toilet facilities

1. Do users feel safe using the toilet facilities during the day? How about at night?
2. Is there sufficient privacy? Do the locks on the doors function adequately?
3. What do you think can be done to improve security of the toilet users?

Water availability for toilet facilities

1. What is the practice for anal cleansing? Is water preferred?
2. What are the main sources of water for toilet facilities?
3. How much water is available for toilet flushing, hand washing and cleaning of toilet facilities?

Operation and maintenance

1. Are there any toilet facilities with problems? (E.g. Full, leaking, fly infestation, cleanliness?)
2. Who is responsible in cleaning the toilets? How often are they cleaned?
3. Whose responsibility is it to get the system working when it breaks down?

Hand washing after defecation

1. How is water stored for hand washing and cleaning of toilet facilities?
2. Are there hand washing points in every toilet block? do they have any problems (e.g. blockages, no soap)?
3. Do you feel that generally there are enough hand washing points?
4. Can you suggest any ways that hand washing operation and maintenance can be improved?

Surface water management

1. When it rains, are there any problems with surface water intrusion around toilet facilities?
2. Do you have any suggestions for improving surface water management?

Household water management

1. How water is typically stored at the household level?
2. What is the condition of the water storage containers?
3. What do you think can be done to improve water storage containers at the household level?

Solid waste management

1. How solid waste is currently managed?
2. Are there designated waste collection points? How frequently is waste collected?
3. Where is waste taken and how is it disposed?
4. Are there any locations with uncontrolled dumping of wastes?
5. What do you feel are the biggest hazards related to solid wastes?
6. Are current waste management practices a threat to water supplies or living areas?
7. What do you feel are the solutions?

Capacity assessment of local solid waste service providers

1. Who is responsible for waste collection and disposal in this area?
2. What resources (excavators, trucks) do they have?
3. Do you have any suggestions for improving the waste management service provided?

Thank you for your cooperation