# DETERMINANTS OF THE EFFECTIVENESS OF COMMUNITY-LED TOTAL SANITATION IN KILIFI AND MARSABIT COUNTIES, KENYA

**TOBIAS MBEYA OMUFWOKO**

**A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY DEGREE IN PUBLIC HEALTH OF MOUNT KENYA UNIVERSITY**

**JANUARY, 2024**

## DECLARATION AND APPROVAL

### Student Declaration

I, Tobias Mbeya Omufwoko confirm that this dissertation was written by myself and has not been presented for the award of any degree in any University.

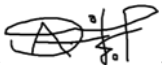
Signature …  ……. Date 2nd. January 2024

TOBIAS MBEYA OMUFWOKO

Admission number PHDPH/2017/67527

### Approval by Supervisors

We confirm that the student has carried out the work reported in this dissertation under our supervision.

Signature ……  …… Date 2nd. January 2024

DR. ALFRED OWINO ODONGO (Ph.D.)

College of Health Sciences

School of Public Health

Mount Kenya University

Signature  Date 2nd. January 2024

PROF. MOHAMED KARAMA, PhD

Deputy Vice-Chancellor – Academics, Umma University

## DEDICATION

This work is dedicated to my late father: Gilbert Maganga Omufwoko, for his love of education.

## ACKNOWLEDGEMENT

I am thankful to God for His guidance. I express my gratitude to my family for their prayers and support. I am grateful for the assistance provided by the School of Public Health in creating a favorable and encouraging atmosphere for learning. I acknowledge my supervisors, Dr. Alfred Owino Odongo (Ph.D.) and Professor Mohamed Karama, for their valuable critiques, feedback and encouragement. Last but not least, thanks to my friends and colleagues who offered me encouragement and moral support.

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## LIST OF ABBREVIATIONS AND ACRONYMS

| | | |
|---|---|---|
| **CBO** | - | Community-Based Organization |
| **CLTS** | - | Community-Led Total Sanitation |
| **CSC** | - | CLTS Steering Committee |
| **CCHWS** | - | Community Health Extension Workers |
| **CHWS** | - | Community Health Workers |
| **CHMT** | - | Sub-County Health Management Team |
| **CPHO** | - | Sub-County Public Health Officer |
| **CWO** | - | Sub-County Water Office |
| **GOK** | - | Government of Kenya |
| **GSF** | - | Global Sanitation Fund |
| **HHWT** | - | Household Water Treatment |
| **IMR** | - | Infant Mortality Rate |
| **JMP** | - | Joint Monitoring Programme (WHO / UNICEF) |
| **KDHS** | - | Kenya Demographic and Health Survey |
| **KS** | - | Kenyan Shillings |
| **KWSP** | - | Kenya Water and Sanitation Program |
| **LATF** | - | Local Authority Transfer Fund |
| **MoH** | - | Ministry of Health |
| **MoPHS** | - | Ministry of Public Health & Sanitation |
| **MWI** | - | Ministry of Water and Irrigation |
| **M&E** | - | Monitoring and Evaluation |

| | | |
|---|---|---|
| **MDG** | - | Millennium Development Goal |
| **NGO** | - | Non-Governmental Organization |
| **NHSP** | - | National Hygiene and Sanitation Policy |
| **PHAST** | - | Participatory Hygiene and Sanitation Transformation |
| **PHT** | - | Public Health Technician |
| **PHO** | - | Public Health Officer |
| **PRA** | - | Participatory Rural Appraisal |
| **RBM** | - | Results-Based Management |
| **SWAP** | - | Sector Wide Approach Programme |
| **SDG** | - | Sustainable Development Goal |
| **UNICEF** | - | United Nations Children's Fund |
| **WAK** | - | WASH Alliance Kenya |
| **WASH** | - | Water, Sanitation and Hygiene |
| **WHO** | - | World Health Organization |
| **WRMA** | - | Water Resources Management Authority |
| **WMC** | - | Water Management Committee |
| **WSSCC** | - | Water Supply and Sanitation Collaborative Council |

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## DEFINITION OF KEY OPERATIONAL TERMS

**Determinants:** These are factors and conditions that affect the correct sanitation practices in the selected population of the study.

**Sanitation:** Sanitation refers to the actions made to promote the use of required tools and infrastructure to ensure a clean and healthy living environment. These actions include advocating for sanitation, raising awareness, providing latrines, toilets, sewers, and connections. Sanitation, as used here, refers to the hygienic methods employed to prevent human exposure to feces, hence preventing infections and promoting health and environmental preservation. It commonly denotes the act of providing facilities and services for the secure disposal of human excrement and urine.

**Community-led total sanitation** (**CLTS**): CLTS is a strategy aims to generate long-term changes in sanitation behavior among individuals who engage in a guided process known as "triggering." The purpose of the triggering is to induce a spontaneous and enduring transformation in social behaviors, specifically the cessation of open defecation. The initial concept primarily aimed to elicit feelings of humiliation and disgust around inadequate sanitation in order to instigate change. Since then, it has undergone additional development by incorporating the knowledge gained from extensive implementation in various rural and urban environments, with a particular emphasis on factors related to a sense of pride.

**Selected population**: Population of interest where the research is being conducted, Rabai Sub County in Kilifi and Saku Sub County in Marsabit Counties, respectively.

## ABSTRACT

Sanitation and hygiene are crucial for human survival, and their inadequate availability negatively impacts the quality of life and development efforts in many areas. SDG 6.2 recognizes the crucial significance of sanitation and hygiene. However, achieving this target is hindered by multiple factors such as human behavior, politics, geography, inequality, urbanization, climate change, and financial deficiencies. Poor sanitation contributes to about 775,000 deaths annually, and is one of the world's largest health and environmental challenges, especially in developing nations. This study examined determinants of major interventional factors on community-led total sanitation as an approach to delivering ODF societies and improving health and wellbeing among the selected population in Kilifi and Marsabit Counties in Kenya. The study methodology included a comparative cross-sectional study of the two diverse study populations. Eight hundred and eleven participants were recruited for the data collection phase of the study. A multistage sampling procedure was used to sample the villages and the households. Quantitative data was analyzed using STATA. Descriptive statistics were used to determine the different regional CLTS uptake. Inferential statistics, including multivariate logistic regression were used to determine associations between variables. Propensity score matching (PSM) was used to estimate the impact of CLTS intervention on the sample population in the two counties. This technique was adopted to eliminate the effect of confounders. All tests in this study were done at the level of significance of $P \leq 0.05$. On average, about 13.45% of residents in the two counties practiced open defecation after intervention, a significant drop from the 30% rate reported in the Water and Sanitation Report. The study found significant statistical association between household heads having a college level education (A.O.R=10.273, p=0.013), household heads being of above 61 years (A.O.R=4.046, p=0.009), households having a cumulative monthly income of between 10,001-15,000 (A.O.R=6.461, p=0.091), and household heads being female (A.O.R=1.792, p=0.03), and owning a sanitation facility. Also, households with household heads having good handwashing awareness (A.O.R=2.459, p=0.002) and CLTS awareness (A.O.R=4.317, p=0.022) were statistically associated with owning a sanitation facility. Furthermore, the PSM analysis demonstrates that CLTS programs impacted sanitations status in Kilifi and Marsabit significantly. The intervention resulted in a 42% increase in households owning a sanitation facility. Conclusively, the study established a statistical significance of CLTS and ownership of sanitation facilities in Kilifi and Marsabit Counties. The results show that CLTS program are effective and have positively impacted sanitation status, such as reducing open defecation levels in Kilifi and Marsabit.

**Keywords and phrases**: sanitation, open defecation-free, handwashing, awareness, intervention, diarrhea

# CHAPTER ONE:INTRODUCTION

## 1.1: Introduction

The chapter consists of the study's background, problem statement, study purpose, overall study objective, specific study objectives, research questions, study hypothesis, study significance, study limitations, and study delimitations.

## 1.2 Background to the Study

Access to water and sanitation is a global challenge. About 61% of the world's population (4.5 billion people) lacked access to safely supervised sanitation services, according to the Joint Monitoring Programme (JMP) Report of WHO and UNICEF (on water supply and sanitation estimates). This indicates that these individuals use a latrine or toilet that does not result in the safe treatment or disposal of excreta. Additionally, there weren't enough handwashing statistics to create a global estimate. Only 15% of people in sub-Saharan Africa had access to a soap-and-water handwashing station (WHO/UNICEF, 2017).

Stunting in children has been connected to poor sanitation, particularly OD, in further research from the World Bank's Water Supply, Sanitation, and Hygiene (WASH) Poverty Diagnostics for 17 countries worldwide (WSP/MOH, 2014). Over 5.6 million Kenyans still urinate in the open, with only 31% of the population having access to improved sanitation in urban areas and 30% in rural ones. If immediate action is not done, diseases including cholera, typhoid, amoebic, and diarrhoea will continue to be prevalent (WSP, 2012). Poor sanitation costs Kenya an estimated Kes 27 billion (365 million USD) annually, or 0.9% of the country's GDP (WSP, 2012). Even though OD costs Kenya $88 million annually, ending the activity would only necessitate the

construction and usage of 1.2 million latrines. In article 43 of the 2010 Constitution of Kenya, sanitation was deemed important enough to be designated a fundamental right. This poor sanitary status can be demonstrated by the current National Cholera crisis, especially in Kibra, Nairobi, that targeted ministers and high-end establishments (WSP/MOH, 2014).

According to the Water and Sanitation Programme in 2012, over half of the population in Kenya, which is around 21 million individuals, utilize unsanitary or communal latrines. Additionally, an additional 5.6 million people do not have any access to latrines and are forced to defecate in open areas. The main factor causing Kenya's 3,500 cholera infections per year on average is faecal pollution of the environment. The required WASH response is expected to cost US$2.2 million annually. However, beyond the immediate response of the health system, a cholera outbreak has economic ramifications (WHO Report, 2021). According to the WSP research, 19,500 Kenyans, including 17,100 children under the age of 5, pass away from diarrheal disease each year, with 90% of these deaths being directly related to inadequate access to WASH (Water Sanitation Programme, 2012).

In Kenya, sanitation is recognized as a constitutional right, and the County Government is entrusted with the obligation of ensuring its provision (KHIS, 2019). In recent years, one form of intervention to reduce OD has gained worldwide attention. Community-led total sanitation has been adopted and implemented in many countries as an approach to putting an end to OD. Without providing subsidies to buy latrine or toilet construction materials, the CLTS intervention comprises facilitating a process to motivate and empower rural communities to avoid OD and to construct and utilise latrines (WHO Report, 2021).

Community members assess their sanitation situation, which includes measuring the extent of OD and the transmission of diseases through fecal-oral pollution. They use Participatory Rural Appraisal methods to gather this information. The CLTS strategy causes the community to feel contemptible and ashamed. They all recognize the horrible effects of OD, including the fact that, as long as it persists, they are consuming one another's faeces. This realization inspires them to start a community-wide initiative to address the sanitation condition (Kamal et al., 2018).

The most extensively used policy intervention for enhancing rural sanitation in low-income countries is CLTS. The SDG of stopping OD, which is currently practised by approximately 900 million people, is the focus of community-led complete sanitation (Kamal et al., 2018). In many nations around the world, CLTS programming and implementation are being carried out. It is a viable option for governments and donors, as it promises to decrease OD and increase sanitation coverage through community mobilisation and shared behaviour change—typically without providing direct financial support for the construction of toilets (USAID, 2018). Kenya initiated the ODF rural Kenya in May 2011. The government aimed to have an ODF Kenya by 2013, and an ODF Rural Kenya Roadmap 2011-2013 was developed. It also aimed to accelerate MDG 7, which the country did not achieve (USAID, 2018). By the end of the period, only 9,126 villages had been triggered. Three thousand nine hundred fifty-six had claimed ODF status, 2,567 had been verified, and a dismal 1,273 had been certified as ODF (Ministry of Health, 2016).

### 1.3 Statement of the Problem

Sanitation interventions' economic and social advantages free up more time for worthwhile activities, which leads to improved output, better academic and professional performance, and fewer medical expenditures. Greater service accessibility results in a better quality of life in terms of status, dignity, safety, convenience, and comfort. The majority of the population in Kenya does not have access to basic sanitation services (Kenya Environmental Health and Sanitation Policy, 2016).

Poor sanitation has proved to be too costly, not only for Kenya but for the whole world in general. The country loses Ksh 27 billion each year due to poor sanitation. In addition, each Kenyan defecating on the open spends almost 2.5 days a year finding a private place to relieve themselves. This leads to huge economic losses due to time lost. Unfortunately, these costs fall disproportionately on women as they are the caregivers of children, the old, and the sick (Water Sanitation Program Report, 2012).

Only 32% of Kenya's rural population has access to better sanitation, and 72% of those latrines only offer various levels of privacy, safety, and hygiene. Despite the government's ambitious ODF Rural Kenya 2013 Campaign Roadmap (WSP Report, 2021) OD is still widespread in Kenya. The nation's rate of OD is 14%, with significant geographical variations. OD is prevalent in some areas, particularly in the northern counties of Turkana (82.2%), Wajir (76.7%), Samburu (73.4%), and Marsabit (64%), according to the WSP Report from 2021. Poor sanitation results in unequal expenses, with the poorest populations bearing a disproportionately large share of the financial burden. A poor person's salary is typically far more heavily weighted towards the average cost of inadequate sanitation than is the case for a wealthy person (WSP/MOH, 2014). Many girls in

Kenya fail to attend school during their menstruation period hence losing out on school time and hence not performing as expected. According to a report from Siaya County, the majority of the rural primary schools in Kenya that were surveyed do not have adequate WASH facilities to meet the MHM needs of menstruation females. Poor WASH conditions in schools may make it difficult for females to focus in class, attend when menstruating, or, at worst, complete their education. (Kelly et al., 2014). This study compared such two ecological zones and study factors influencing these disparities, and contribute solutions that would hasten the attainment of sanitation achievement. Previous studies have explored the effectiveness of CLTS interventions in ending OD using behavioural change models such as the theory of reasoned action, theory of planned behaviour, social cognitive theory, health belief model, and the transtheoretical model (Sigler et al., 2014). Most studies focus on examining the effectiveness of CLTS in increasing latrine coverage in rural areas (Harter et al., 2020). However, there is limited evidence regarding the effectiveness of CLTS interventions on sanitation factors in different rural settings, particularly the sedentary (Kilifi County) and nomadic agro-ecological areas (Marsabit), that exhibit varying social cultural and social demographic factors, and using the social norms theory as a lens; hence, the knowledge gap. This study, therefore, assessed the effectiveness of CLTS interventions on sanitation factors in sedentary and nomadic agro-ecological areas of Kilifi and Marsabit, as a reflection of all such areas in Kenya and globally.

### 1.4: Purpose of the Study

Sanitation is not only a public health and dignity issue, but a livelihood and survival issue, and its impact on human beings is demonstrated in the disease burden, mortality and morbidity, and the low sanitation coverage in Kenya (MOH Report, 2021). There are great disparities among various

ecological zones. This study has generated data and information to inform policymakers, programs, scholars, and the general public on the relationships between different agro-ecological zones and access to sanitation (WHO Report, 2021). The findings will assist in making informed choices in targeting the scaling up sanitation coverage, to meet the SDGs and also for disease prevention, dignity and economic development. The study also sought to assess the equitable impacts of the CLTS intervention in Rural Kenya since its introduction in 2013 (MOH Report, 2021), with the study areas as reference points.

The study gathered information on whether the intervention has yielded its much-needed impact of ending OD or if the country will need another innovative intervention to end OD. The study informs communities in identifying and mitigating their socio-economic determinates to access to improved sanitation access and make deliberate choices regarding their mitigation or reinforcement (MOH Report, 2021). The study demonstrated that sanitation-related conditions and issues are preventable and controllable, by the provision of improved sanitary facilities, for everyone, everywhere, and this can be achieved if we identify and deal with the intrinsic and extrinsic prevailing factors and conditions (Harter et al., 2020).

## 1.5: Objectives of the Study

### 1.5.1 General Objective

To assess the determinants of the effectiveness of CLTS among communities in Kilifi and Marsabit Counties in Kenya.

### 1.5.2: Specific Objectives of the Study

1. To assess ODF status among communities in Kilifi and Marsabit Counties in Kenya.
2. To assess the level of awareness of CLTS among communities in Kilifi and Marsabit Counties in Kenya.
3. To evaluate the morbidity of diseases , associated with sanitation, (diarrhea and dysentery), in under five years old children among communities in Kilifi and Marsabit Counties, Kenya.
4. To determine the major factors influencing the effectiveness of CLTS among communities in Kilifi and Marsabit Counties in Kenya.

### 1.6: Research Questions

1. What is the status of OD and ODF among communities in Kilifi and Marsabit Counties in Kenya?
2. What is the level of awareness of CLTS among the selected population of Kilifi and Marsabit Counties, Kenya?
3. What is the morbidity of diseases associated with sanitation (Diarrhoea and dysentery, ) under under-five years old children among communities in Kilifi and Marsabit Counties, Kenya?
4. What are the major factors influencing the effectiveness of CLTS among communities in Kilifi and Marsabit Counties in Kenya?

**Ho: Null Hypothesis**

There is no statistically significant difference in the effectiveness of CLTS intervention in Kilifi and Marsabit Counties in Kenya.

## 1.7: Significance of the Study

Article 43 of the 2010 Kenyan constitution guarantees every Kenyan the right to reasonable standards of sanitation, and a clean, and healthy environment. Diarrhoea and typhoid morbidity is unacceptably high even when it is preventable (KHIS, 2019). In general, poor sanitation has greater effects (in terms of lost man-hours from work and cost of healthcare) on industries and society than on workers themselves. The issue of sanitation (OD) has evolved into a serious public health problem that, if ignored, will have a heavy impact on society, government, and individuals, thereby reducing the quality of life of an individual. While information on the main risk factors for contagious illnesses such diarrhea, dysentery, and worms is readily available in many industrialized nations, it is hard to find in many developing nations. Efforts to prevent infectious disease outbreaks are severely hampered by the lack of this information on the conditions and variables driving sanitation inequities, notably as seen in the table below.

**Table 1.1: Trend of Diarrhea and Typhoid Cases for Under 5s and Above 5s**

Source (KHIS, 2020).

| | | 2017 | 2018 | 2019 |
|---|---|---|---|---|
| Diarrhoea | Under 5s | 3564 | 5714 | 6653 |
| | Above 5s | 3037 | 4776 | 6121 |
| Typhoid | Under 5s | 1598 | 2897 | 4332 |
| | Above 5s | 229 | 250 | 395 |

The results of this study contribute to aligning sanitation programming by government, and non-state actors: including development partners, private sector and Civil society organizations, to different geographical and socio-economic zones, to accelerate SDG 6.2. Also, the results of this study will add to a pooled knowledge from similar or related research work undertaken internationally and nationally, on CLTS and identify opportunities and gaps for related research work.

### 1.8: Scope of the Study

CLTS is an ongoing government sanitation intervention program in the two counties. The scope of this study, therefore, covered a review of the sanitation activities from known records of the Kilifi and Marsabit Counties in Kenya, from the project intervention period of November 2020 to November 2021. The study compared and contrasted differences in CLTS outcomes during this period, in relation to the baseline, at the beginning of the intervention. The parameters reviewed were the rate of improvements in peoples' awareness, ODF status, morbidity related to sanitation, as drivers and barriers to improved sanitation. In general, socio-economic, equity/gender issues, and knowledge attitudes and practices that improve sanitation in the two agro-economic zones were considered. The outcome of the interventions was evaluated in reference to the two counties.

The study covered key areas and parameters for effectiveness, and sustainability. Levels of performance at each level were targeted to sort out best practices and implementation challenges that could accelerate sanitation coverage. Baseline data at each of the two counties, progress reports, and field data were useful reference information that helped understand the sanitation status context and performance.

# CHAPTER TWO: LITERATURE REVIEW

## 2.1: Introduction

Chapter two consists of the introduction to the chapter, the theoretical framework of the study, empirical literature review of the study, critical literature review, the conceptual framework of the study, and a summary of the conceptual framework.

According to the Kenya Environmental Health and Sanitation Policy, sanitation is a fundamental requirement that improves human health, dignity, and quality of life. Sanitation improvements have positive economic and social effects that result in more time for productive activities, improved production, better school and work performance, and fewer medical costs. Better living conditions, dignity, safety, comfort, and status result from closer proximity. The bulk of the population in Kenya, however, lacks access to basic sanitation facilities. Since the impoverished lack access to decent and dignified lifestyles, human environment, health, and well-being are all compromised (MOH, Kenya Environmental Health and Sanitation Policy, 2016)

## 2.2: Theoretical Literature Review

The theoretical framework focus on the triad theory or triangle of the disease's causation, health belief models, and Precede-Proceed theory of the study.

### 2.2.1 Triad Theory (Triangle) Model

The Epidemiologic triangle is the name given to the conventional models of infectious disease causation. An outside agent, a host, and the environment make up the triad or triangle of epidemiology, where the host and agent both contribute to the development of a disease that affects the host (a human or an animal). The pathogen-transmitting organism's vector contributes to the

process of disease infection by moving pathogens from one host to another without inflicting illness on its own (Susanto, 2015).

The host, agent, and environment aspects interrelate in a variety of unique ways to deal with the production of the illness. Various illnesses need different balances and associations of these three aspects. The introduction of suitable, practical, and effective public health measures to prevent and control illnesses needs to evaluate each of the three elements of their interactions (Surya & Susanto, 1998).

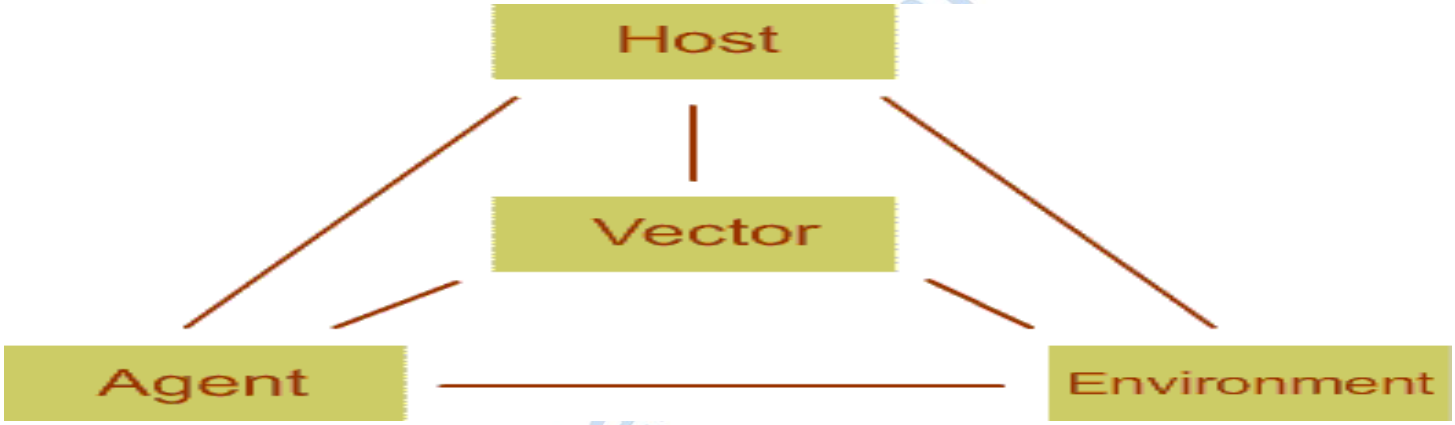


**Figure 1.1: Epidemiologic Triad or triangle of the Disease Causation (Historical)**

Source: Thomas (2002).

**2.2.1a): The Host**

There are various ranges of hosts in the Triad Model. For example, Malaria infestation in Africa sub-Sahara, the malaria parasite life cycle includes two hosts. In the process of bloodsucking as a way of feeding, the anopheles mosquito causes malaria in humans through inoculating sporozoites into the body of a person.

The sporozoites contaminate the liver cells of humans and are framed into schizonts, which break and release merozoites. After this, the parasites undergo basic reiteration in the erythrocytes (erythrocytic schizogony). The merozoites infected the blood cells (Hernán et al., 2004).

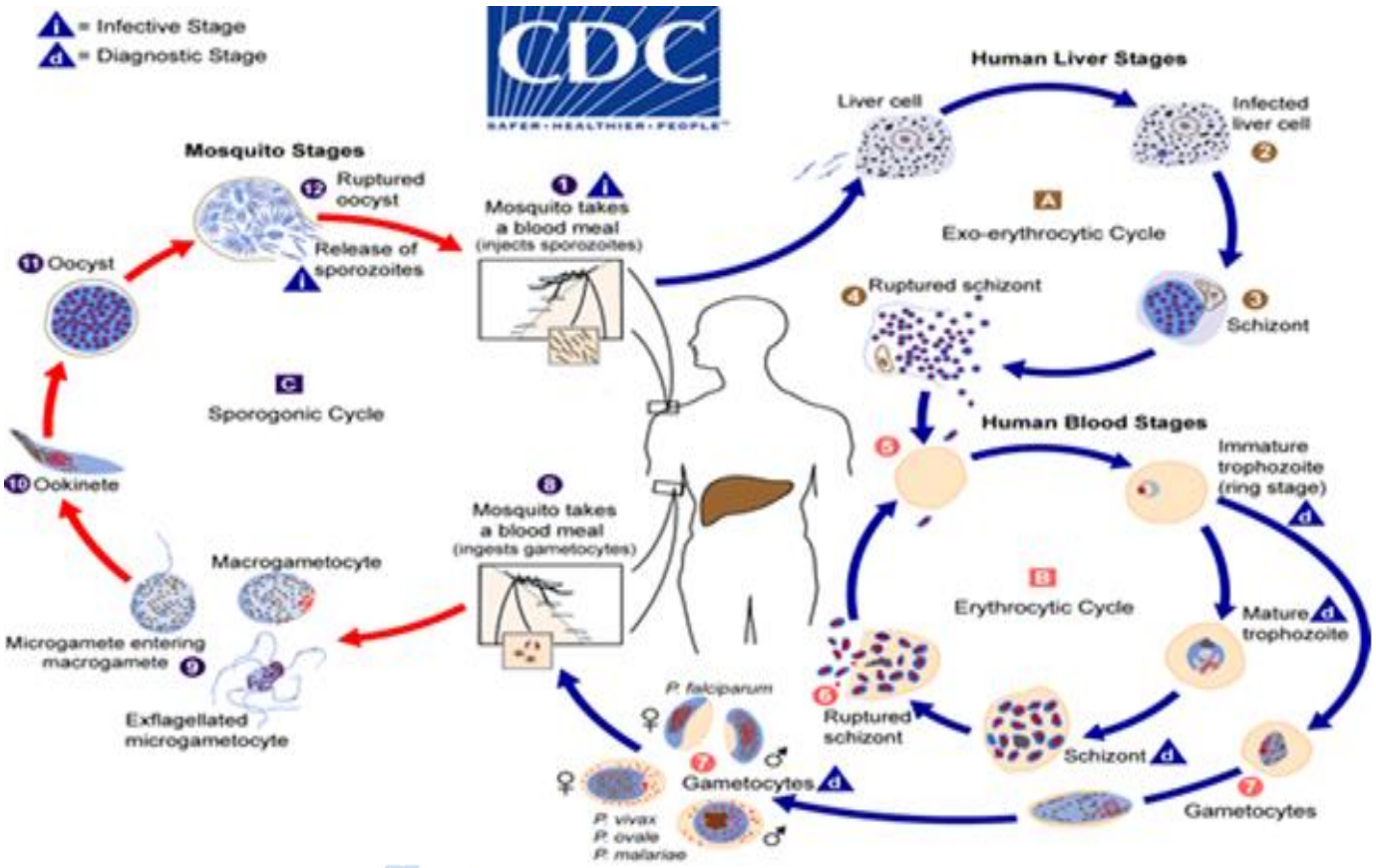


**Figure 2.2: Agent Theory of Malaria Source**: CDC (2014).

### 2.2.1b). The Agent

In the example, the parasite of the Plasmodium genus is the primary cause of malaria. Four species of Plasmodium can transmit infection in human beings. Falciparum is the main source of a serious type of malaria affecting children under five (Swenson & Wretman, 1992).

### 2.2.1c): The Environment

One of the epidemiological triangles of the disease's causation, the environment "alludes to extraneous variables that influence the agent and the opportunity for presentation," according to the epidemiological model. The crucial Physical aspects, such as geography and climate or atmosphere, biological aspects, such as an insect that spreads the causative agent, and socioeconomic aspects of malaria, such as overcrowding, hygiene, and the accessibility of health services, are all environmental factors that affect the parasites that cause malaria (Garrec, 2003).

This model contends that illness is caused by the smell of decomposing organic substances. It can be traced back to the days of the Hippocratic impression that illnesses are identified with environmental change. It likewise differentiated pointedly from the other three speculations since it reasonably divided the source of the sickness from the setback of the disease (Garrec, 2003). The causal relationship theory is true for malaria as it is for the relationship between sanitation and environmental factors and diseases related to sanitation.

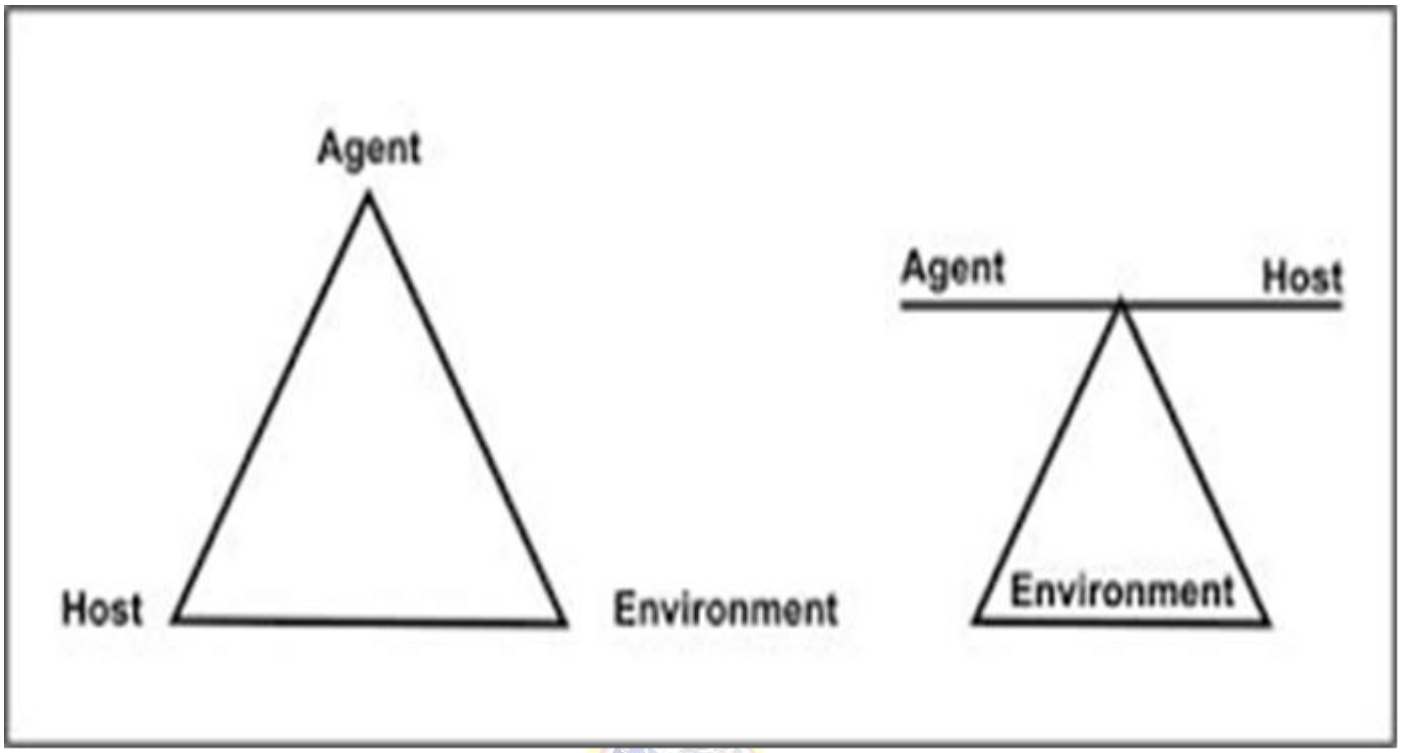


**Figure 2.3: Epidemiologic Triad of Causative Environmental (Historical)** Source: Gandhi and Kishor (1986).

### 2.2.2: PRECEDE-PROCEED Model

The PRECEDE-PROCEED strategy is a comprehensive framework used to identify health needs and to create, implement, and analyze public health initiatives that aim to promote healthy lifestyles. The PRECEDE model offers a strategic framework for designing a focused and intensive public health program. Additionally, it offers the structure for executing and evaluating the public health program.

PRECEDE is a shortened form of the acronym Predisposing, Reinforcing, and Enabling Constructs in Educational Diagnosis and Evaluation. It involves assessing the following components of the neighborhood:

Perform a social assessment to determine the social problems, needs, and desired results of a population.

Epidemiological Assessment: Determine the health issues that are contributing to the difficulties encountered, and thereafter establish goals and objectives.

Ecological Assessment: Analyze the environmental and behavioral elements that contribute to the specified behaviors and lifestyles, as well as those that support and strengthen them.

Identify the administrative and policy factors that influence implementation and align them with the appropriate interventions to facilitate the desired and expected transformations.

Implementing initiatives.

PROCEED is an acronym that stands for Policy, Regulatory, and Organisational Constructs in Educational and Environmental Development. The process involves identifying desired outcomes and executing the program: designing the intervention, evaluating resource availability, and implementing the program.

Process Evaluation: Determine if the program is effectively reaching the target audience and achieving the established objectives.

Impact Assessment: Evaluate the alteration in behavior.

Outcome Evaluation: Assess whether there has been an increase in observed positive behavior or a decrease in the occurrence or prevalence of the identified negative behavior.

### 2.2.2a Implementation Considerations

The framework of the PRECEDE-PROCEED paradigm facilitates the planning and execution of programs aimed at promoting health or preventing sickness. This technique has demonstrated efficacy in addressing many health promotion concerns, including both single interventions and continuous programming. Like the Community Readiness Model, PRECEDE-PROCEED promotes community involvement and has the capacity to enhance local program ownership.

The PRECEDE-PROCEED model was specifically designed for implementation in the field of public health. However, its fundamental principles are equally relevant to other matters concerning local communities. Therefore, it will function as a prototype for both comprehensive community intervention and targeted health intervention. Contrary to commonly held beliefs, PRECEDE/PROCEED lays significant emphasis on the community as a valuable source for promoting health. During the latter half of the 20th century, the eradication of numerous infectious diseases through medical progress resulted in chronic diseases including heart disease, stroke, cancer, and diabetes emerging as the primary causes of disability and death in industrialized nations. Consequently, the focus on maintaining good health has changed from simply treating illnesses to preventing these conditions. More recently, there has been a shift towards actively encouraging behaviors and attitudes such as following a healthy diet, engaging in regular exercise, and reducing stress. These factors greatly contribute to preserving health and prolonging and enhancing the quality of life.

Premises on disease prevention, health promotion, and therefore other community-related issues underlie PRECEDE-PROCEED. These include Those whose actions or behaviours you want to

change must be participating in health promotion since people almost always choose to engage in health-promoting behaviours and activities. The PRECEDE-PROCEED process should commence with the inclusion of all stakeholders, or those impacted by the issue or situation in question.

Health is inherently a social issue. The town's character is shaped by the community's ideas, as well as the physical, social, political, and economic settings, and its history. Health should be viewed in the context of quality of life, as this provides the most accurate representation of total health. It is merely one of numerous aspects that impact the level of success or failure individuals and the community experience in their lives. Consequently, it has a broader influence and is influenced by a greater number of factors than what is initially seen to be linked to it. Lastly, being healthy involves a broader scope than solely physical well-being or the lack of disease, injury, or illness. A combination of economic, social, political, ecological, and physical variables contributes to the development of healthy and high-quality lifestyles for individuals and communities.

This comprehensive viewpoint on health also considers other local issues. A community can be deemed healthy if it demonstrates fitness in various aspects, including the physical well-being of its inhabitants. The overall well-being of a community can be assessed based on various factors, such as its support for families, the upbringing and support it provides for children, its promotion of lifelong learning, its provision of meaningful employment opportunities for residents, its encouragement of participation in democratic processes, its assistance to those in need, its preservation and sustainability of the natural environment, its support for the arts, its

appreciation and promotion of racial and cultural diversity, and its efforts to promote and maintain safety and physical health.

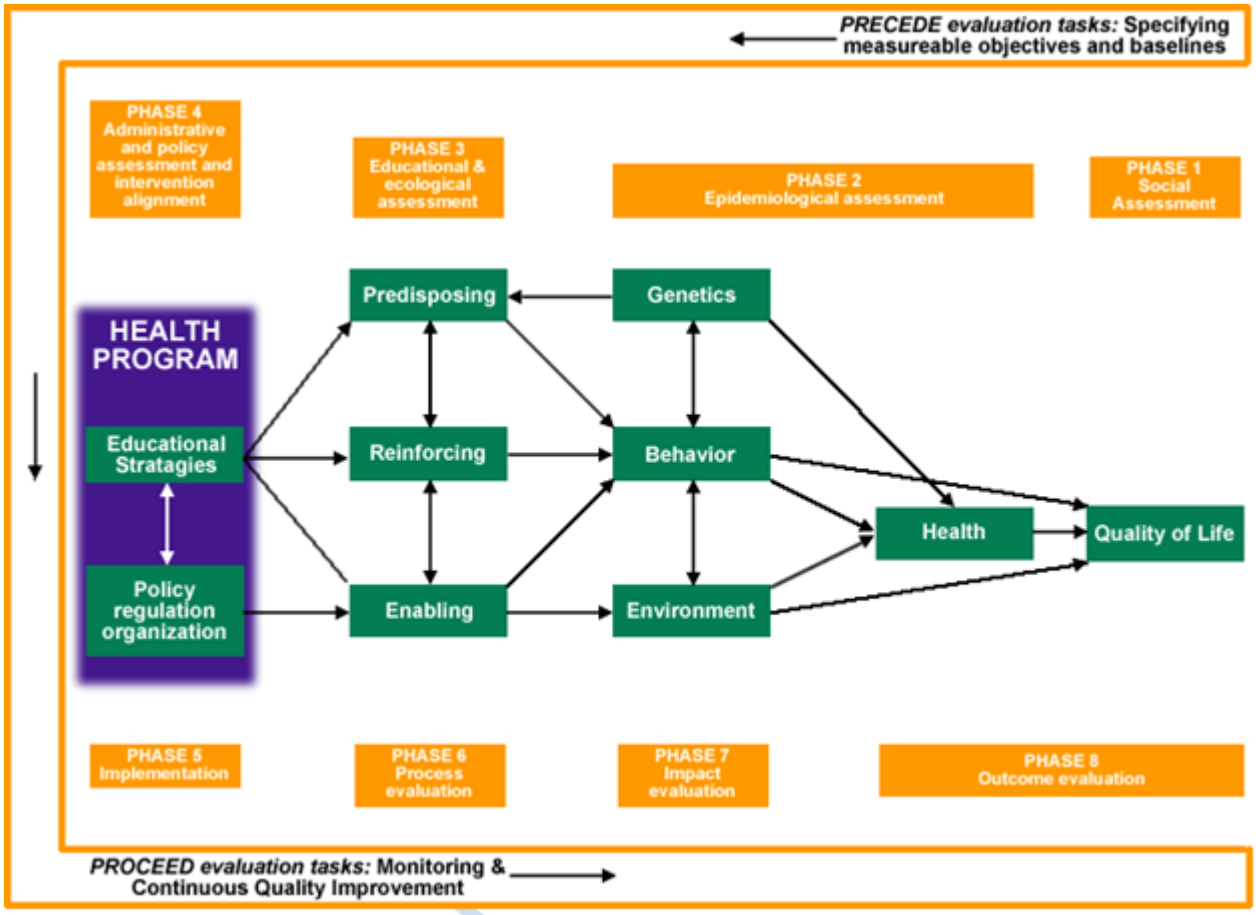


**Figure 2.4: Generic Representation of the PRECEDE-PROCEED Model** (Green & Kreuter, 2005)

The PRECEDE-PROCEED paradigm prioritizes health promotion above disease treatment, while still adopting a medical perspective on public health. The concept posits that a comprehensive diagnosis should precede a public health intervention, analogous to how a diagnostic evaluation precedes therapy in the field of medicine. A diagnosis provides a

suggestion for a specific action or intervention, which is carefully monitored to observe its progress, influence, and final result. The fundamental principle of the approach is that a diagnostic should commence with the desired result and then proceed in reverse to ascertain the necessary actions to get it.

The fundamental principle of the model is that enhancing the well-being of individuals and their community is closely intertwined with the objective of a health program, and thus, the objective of any proactive form of community intervention. Hence, regardless of whether an intervention is aimed at a certain target demographic, it should be implemented at the community level and take into account the community's requirements.

The ultimate principle of any community-based intervention model is that the successful implementation of a community intervention requires the collaboration of various organizations and professionals, policymakers, local leaders, and the general public, including individuals from the target population. For ensuring precise information and community support, it is imperative to incorporate all constituents of the community right from the beginning of the process.

The Precede-Proceed theory offers is an excellent reference theory for measuring sanitation baseline, objectives and continuous monitoring of improvements in sanitation status in the community

### 2.2.3: The Social Cognitive Theory or Behaviour Change Model (BCM)

The theory focuses on understanding what variables are critical to behaviour change and how the variables interrelate. The Behavioral Change Theories that provide information regarding the

consequences of community-wide OD include the theory of reasoned action, theory of planned behaviour, social cognitive theory, health belief model, and the trans-theoretical model.

The Theory of Reasoned Action (TRA) states that an individual's behavior is influenced by their intention to engage in that behavior, which is in turn influenced by their attitude towards the behavior and subjective norms (Fishbein & Ajzen, 1975). The hypothesis is grounded in the observed activity of an individual, and hence, it is contingent upon their attitude. The theory of planned behavior is a conceptual framework employed to comprehend and forecast human actions. It posits that behavioural intentions directly influence behaviours and, in certain circumstances, perceived behavioural control (Martin, 2017). According to the TPB, successful behavior depends on both motivation (intention) and capacity (behavioral control).

The Social Cognitive Theory (SCT) explains how individual health behaviors are influenced by personal experiences, the behaviors of others, and environmental circumstances (Stajkovic & Sergent, 2019). The Social Cognitive Theory (SCT) provides avenues for social support by establishing expectancies and self-efficacy, and by employing observational learning and other reinforcements to achieve behavioral change (Stajkovic & Sergent, 2019). The Health Belief Model (HBM) is a theoretical framework that is utilized to direct health promotion and illness prevention efforts (Luquis & Kensinger, 2018). The idea is utilized to elucidate and forecast individual modifications in health behaviors. The core principle of the Health Belief Model (HBM) is the emphasis on an individual's personal beliefs about health issues, which influence their health-related behaviors (Luquis & Kensinger, 2018).

The transtheoretical model (TTM) of behavior change is a comprehensive therapy approach that assesses an individual's readiness to adopt new, healthier behaviors and provides strategies or processes of change to assist the individual (Liu, 2018). According to the Transtheoretical Model (TTM), individuals progress through six distinct stages of change: pre-contemplation, contemplation, preparation, action, maintenance, and termination (Liu, 2018).

Distinct intervention tactics are employed for each step of change to facilitate the individual's progression to the subsequent stage and ultimately, to the maintenance phase, which represents the desired behavioral state (Liu, 2018).

As part of Social Cognitive Theory or Behaviour Change Model (BCM)mentioned above, the main emphasis of this study was on Perkins and Berkowitz's (1986) social norms theory (SNT) which focuses on understanding the environment as well as interpersonal influences to change behaviour, which is viewed as a more effective approach than an emphasis on the individual to change existing behaviour. The SNT can be used to create a paradigm shift to end OD. The steps towards creating new social norms in CLTS include triggering tools, collective action planning, formation of community WASH groups, pledges, signs, and maps with latrines, as well as verification, certification, and rewards (Gnilo, 2014).

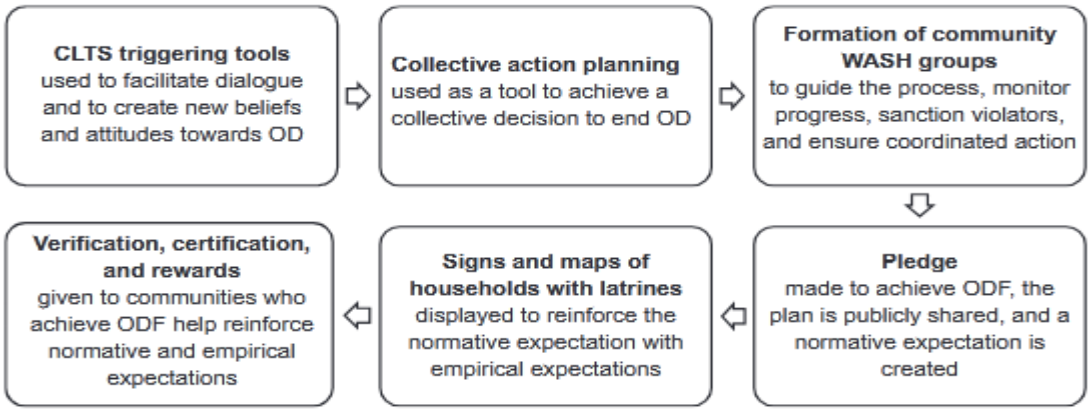


**Figure 2.5: Steps Towards Creating New Social Norms in CLTS** Source: Glino et al. (2014).

One of the theories with which there is a lot of overlap is the social psychological theory. According to this theory, parts of a person's information achievement can be openly observed in others who share similar social relationships, experiences, and external media influences. Albert Bandura advanced his social learning hypothesis with the creation of this theory (Bandura, 2008). Based on the social cognitive hypothesis, the general public observes a model engaging in healthy conduct and the resulting outcomes. They then remember the sequence of events and use this information to regulate their own subsequent activities. Observing a model can potentially motivate the observer to replicate the activity that they have already been proficient in. In various manifestations of social intelligence, the general populace does not fully acquire accustomed to the prevalent practices through endeavoring and succeeding or failing, but rather, human existence is dependent on the reproduction of others' works. The eyewitness may replicate the behavior displayed if the reliance on the general public is compensated or rejected for their conduct and the results of the behavior (Evans & Bandura, 1989).

A wide spectrum of people in a variety of environmental contexts are given models by the media. The social psychology theory is a learning theory that takes into account the potential that people pick up skills by seeing how others behave. These wise actions can form the basis of one's personality. While social clinicians concur that the environment one experiences as a youngster influences one's path, the unique individual (and subsequently information) are more crucial (Bandura, 1989). People pick up knowledge via watching others, with the earth, leadership, and wisdom functioning as the primary elements that influence the development of an equal triadic relationship. Any behavior can alter a person's mindset (comprehension) if it is observed. Earth as a comparison is one that affected and shaped customs. For instance, a parent's attitude (and perception) can influence how they raise their children (Bandura, 2011). In conclusion, Professor Bandura's method of observational learning and modeling includes the steps listed below:

Listening: In order to acquire knowledge, it is necessary to be attentive. Learning by observation is hindered by any distraction that diverts your attention. If the situation presents a new element or the model is captivating, you are far more inclined to focus just on acquiring knowledge.

Retention: Retention is an essential aspect of learning as it refers to the capacity to retain knowledge. Retention, the capacity to store and recall knowledge, is vital for observational learning. However, various circumstances might impact the ability to retain information.

Procreation: This involves imitating the conduct you carefully observed from the model and remembering the details. Through increased repetition, the acquired behavior improves and the abilities become more robust.

Motivation: In order for observational learning to be successful, it is crucial that you possess the motivation to replicate the behavior that has been demonstrated. Punishment and reinforcement are important factors that strongly influence motivation. Observing others being praised or punished can be equally beneficial as yourself experiencing these incentives. One example of a proactive approach is to arrive at class a few minutes early each day if you observe that another student receives more credit for punctuality (Bandura, 2011).

## 2.3: Empirical Literature Review

### 2.3.1: Global Perspective of OD

OD since time immemorial remains a teething problem globally, internationally, nationally and especially in developing countries (*WHO/ UNICEF, 2015*).

Globally OD in rural households is evident, with social, economic, and cultural factors. Other factors include, Ownership of latrine is also determined by socio-economic and cultural factors (World Bank, 2014). Countries south of the Africa Sub-Sahara practice OD, which the Millennium Development Goal (MDG's) era ended without the target being met (UN MDGs Report, 2015).

Indonesia is among the three countries with the highest burden of OD, with an estimated 29 million to 31 million individuals still using this practice. With the national mid-term development plan aims to end OD by 2019 (WHO Report, 2021) high levels of stunting remain a problem and seem to be linked to poor sanitation and untreated drinking water. The Indonesian government has been working hard to provide everyone with access to sanitation, notably through speeding up the MoH's national sanitation initiative, known in Indonesian as Sanitasi Total Berbasis Masyarakator Community-Based Total Sanitation (IMH, 2020).

Financial constraints dictate to the families what to be given priority in the household budget and as to such opt for OD so that they can have food on the table with the little finances they have (Osumanoet et al., 2018). Likewise, social norms, which govern individuals in African families, dictate the behaviour of some family members and, to some extent, are contributory factors to OD, and this is rooted in the culture and traditions. OD is considered the most common sanitation method among the poorest household (Achoki et al., 2016). Joint monitoring program for water supply and sanitation (JMP) a new sanitation ladder is to be put in place to track the progress of SDGs, where OD is at the bottom of the ladder (WHO/ UNICEF JMP; 2017). In this perspective, countries are encouraged to move out of OD stages because this is a risk factor for diarrheal diseases, cholera, and soil-transmitted helminths, as summarized by a study done by (Gangly et al., 2017).

The OD rate in Kenya is approximately 14%, with significant inequalities observed within counties such as Turkana, Wajir, and Samburu, where the rate exceeds 70%. OD in Kenya is closely linked to poverty, as impoverished people often rely on makeshift latrines that quickly become full and are susceptible to collapse during high rainfall or floods (Odagirc et al., 2017).

### 2.3.2: African Context in OD

In the African context, ODF status in the communities has always been a challenge, especially in the rural areas in the South and Eastern African region. In Malawi, there is a 14% slippage from sampled villages that were already declared ODF between the time of declaration and the period of the study. Also, Eritrea reported a slippage of 27% and Uganda an average of 30% (Gabrielle, 2017). The primary factors contributing to this lapse, according to discussions and observations,

are finding OD convenient or easier, being unable to cover the cost of building, and becoming weary of having to fix latrines every year. Similar to how less fortunate groups lack community support for building latrines, misperceptions about culture and religion, and many other things. Physical observation shows that some latrines frequently fill up and have their superstructures broken, which discourages people from using them (Gabrielle, 2017).

Fagunwa et al. (2023) examine the issue of OD in Africa and its detrimental impact on the attainment of the SDGs. Sanitation and development activities encounter significant challenges due to the high frequency of OD in poor countries. The research proposes a prioritization framework consisting of three tiers, namely critical, high, and medium areas, to focus developmental efforts on effectively eliminating OD. This priority system was developed by utilizing data from the World Bank and the Demographic and Health Surveys (DHS). The OD rates were computed at both the national and subnational/regional levels in order to pinpoint the locations that were in greatest need of targeted interventions. Regression analysis was used to identify predictors for OD practice.

Fagunwa et al.'s study shows that the majority of people in various African nations, including Nigeria, Ethiopia, Niger, the Democratic Republic of the Congo, Burkina Faso, and Chad, struggle with OD. The study also revealed differences in access to basic sanitary facilities, with rural inhabitants and those in poverty having the most difficulty. The poorest people were found to be 43 times more likely to use OD than the wealthiest people, indicating that poverty is a significant factor in this practice. The researchers propose evidence-based targeted interventions that focus on areas and communities with the greatest need for improved sanitation infrastructure and initiatives to address this important problem. Due to the significant frequency of OD in its

communities, West Africa in particular needs special attention. To effectively combat OD, poverty and inequality must be addressed. Investments in sanitation infrastructure, the promotion of behavioural change, and multistakeholder cooperation should also be encouraged. In order to assess the effectiveness of OD mitigation measures and keep track of public health consequences, the study suggests incorporating variables like antibiotic resistance (AMR) into significant health surveys. In general, study provides insightful information about the seriousness of the OD issue in Africa and the need of prioritising focused interventions. It highlights how important sanitary infrastructure, behavioural modification, and equity issues are in dealing with this problem. The conclusions are more credible because they are based on in-depth data analysis from reliable sources.

Belay et al. (2022) examined the prevalence and causes of OD among families in sub-Saharan Africa (SSA). OD makes it easier for diarrheal infections to spread and puts girls and women at risk of sexual exploitation. A total of 452,281 households from 33 SSA nations were included in the study's analysis. With significant differences between nations, the pooled prevalence of OD practice in SSA was found to be 22.55%. There were community-level characteristics like residence, country income status, and area as well as individual-level ones like age, education, media exposure, economic status, and availability to drinking water that were linked to the practice of OD. OD was disproportionately concentrated in poor households, according to the concentration index (pro-poor distribution).

Belay et al.'s study offers important new information about the frequency and causes of OD in SSA. The results are probably representative of the region because they were obtained using a sizable dataset from numerous nations. There are some limitations to take into account, though.

First, the study uses data from the Demographic and Health Survey, which could be biased or have imperfect data collection techniques. The accuracy of the results could be impacted by the incompleteness of the data in some nations. Second, because the study uses cross-sectional data, causality cannot be deduced from the results. Although connections between variables and OD are found, a cause-and-effect link cannot be proven by the study. A problem with variability also exists. Some SSA nations have dramatically variable rates of OD. This shows that there may be country-specific policies and interventions needed because the factors driving OD may not be consistent throughout the entire region. Finally, the analysis leaves out a few significant components. Several individual and community-level elements connected to OD are highlighted in the study, but other crucial factors including cultural norms and governmental laws are not specifically covered. However, the report gives recommendations for tackling OD, including media exposure, education, and targeted subsidies, notwithstanding the shortcomings. These suggestions are helpful, but depending on the circumstances in a given country, their viability and efficacy may differ. Overall, the study offers important information about the frequency and causes of OD in SSA. This data can serve as a starting point for policymakers and program designers as they develop targeted initiatives to address OD and enhance public health in the area. However, further investigation is required, and elements unique to each nation must be taken into account, in order to design complete and successful plans.

Seidu et al. (2021) studied how women dispose children's feces. The study found that sanitation initiatives in Sub-Saharan Africa (SSA) tended to prioritize home sanitation over the significance of properly discarding children's feces. This study sought to uncover the personal and

environmental factors that influence how women in 15 SSA nations safely dispose of their children's waste.

Seidu et al.'s study used secondary data from the Demographic and Health Surveys (DHS), which included 128,096 mother-child pairs with children under the age of five and were conducted between 2015 and 2018. The safe disposal of children's stools was examined using multilevel logistic analysis, and the findings were presented as adjusted odds ratios (AOR) with statistical significance set at $p< 0.05$.

The results showed that, with considerable regional differences, 58.73% of women in the 15 SSA nations safely disposed of their children's feces. The percentage of safe disposal was highest in Rwanda (85.90%) and lowest in Chad (26.38%). The practice was influenced by several personal and environmental circumstances. According to the study, newborns under one had a higher chance of being safely disposed of than those under one. The study also discovered that children with diarrhea were more likely to be safely disposed of than children without diarrhea. Mothers with only a primary education were less likely to conduct safe disposal than mothers with a higher level of education. In addition, compared to older people who were not exposed to radio, women aged 35 to 39 and those who were exposed to radio had increased odds of safe disposal. Last but not least, chances of safe disposal were lower for married moms and adherents of Traditional African Religion.

The disposal of children's waste was discovered to be impacted by a number of contextual factors as well. Women were more likely to conduct proper disposal if they had access to better water and restroom facilities. Additionally, people who lived in rural areas and in bigger homes (those with

five or more children) were less likely to dispose of human waste correctly. Lastly, the likelihood of safe disposal was lowest for women in Central Africa.

The study emphasized the significance of taking into account both within- and between-country variables when developing interventions to encourage the safe disposal of children's waste. It was recommended that an efficient way to improve safe disposal procedures would be to target audio-visual instruction at rural women and big households. Moreover, governments were asked to create workable and affordable plans to expand access to better toilet facilities for households because safe stool disposal was directly linked to increased latrine usage in SSA.

The study's findings emphasized the importance of addressing the crucial problem of children's waste disposal in SSA. To enhance sanitation and health outcomes for children and people in the area, targeted interventions can be devised by identifying the factors impacting this practice at both the individual and contextual levels. Governments and NGOs must work together to create comprehensive sanitation initiatives that encourage safe disposal techniques and give households in sub-Saharan Africa access to better toilet facilities.

The study by Seidu et al. has both strengths and limitations. The study's large sample size, which included 128,096 mother-child couples from 15 sub-Saharan African nations, is one of its key strengths. The use of secondary data from the Demographic and Health Surveys (DHS) could, however, have certain drawbacks. For instance, the information gathered through DHS questionnaires may not have been intended to particularly address the research topic of the safe disposal of children's feces, which could result in inaccurate or insufficient data. In terms of methodology, it is reasonable to utilize multilevel logistic analysis to investigate the relationship between personal and environmental characteristics and the practice of safe disposal. The paper

does not, however, provide a thorough explanation of the model that was employed, including why random effects were included and why this analysis method was chosen over others. Concerns regarding possible model selection bias or confounding variables are further raised by the absence of sensitivity analysis or model diagnostics. Additionally, no causal inference could be drawn. The study finds correlations between a number of variables and the practice of properly disposing of children's waste. It does not, however, prove causation. Cross-sectional research that rely on secondary data have an intrinsic drawback because only experimental designs or long-term studies can establish causality.

In addition, the study's assessment of safe disposal techniques is based entirely on mothers' self-reported data, which could introduce recollection bias and social desirability bias. People could overreport positive behaviors while underreporting negative ones, which could cause an overestimation or underestimating of the prevalence of safe disposal. Although the study reveals a number of contextual elements linked to safe disposal techniques, it ignores certain important aspects that might affect sanitation behavior. For instance, although they have not been fully investigated, local cultural traditions and access to sanitation infrastructure, such as the availability and usability of latrines, may have a substantial impact on safe disposal practices. The study also has a problem with its narrow range of factors. The essay primarily focuses on socioeconomic and demographic aspects of mothers and households. However, other crucial aspects that affect safe disposal practices, such as social support networks, cultural beliefs, and community standards, are not well covered.

The study exclusively uses data from 15 sub-Saharan African nations, despite the enormous sample size, which restricts the applicability of its conclusions to the entire SSA region. The results

might not be generalizable to all the nations in the region due to the varying cultural, economic, and geographical aspects of SSA countries. Although the study highlights parameters linked to safe disposal methods, it doesn't offer any specific suggestions for focused actions. In order to effectively address the issue at hand, policymakers and practitioners need to receive clear recommendations. The study's temporal span is another aspect. The study uses data from 2015 to 2018, and because social and environmental elements are changing, the results could not accurately reflect the state of the world now. More pertinent insights could be gained through an updated analysis. Last but not least, the study makes no specific mention of ethical issues including informed permission, confidentiality, and possible harm to responders. Due to the delicate nature of the study's topics—sanitation procedures—ethical standards need to have been established and followed.

The study has some limitations that should be taken into account when interpreting its results, despite the fact that it offers useful insights into the proper disposal of children's feces in sub-Saharan Africa. To design more thorough and dependable interventions for enhancing sanitation practices in the area, future study should address these constraints and explore additional pertinent elements.

Abebe and Tucho (2020) critically review literature on the rise in OD and the decline of certified ODF villages in Ethiopia. Despite substantial advancements in sanitation initiatives, the survey discovered that rates of OD have been increasing. The researchers reviewed 12 publications after conducting a thorough literature search from 2013 to 2019. The pooled estimate of the ODF rate in Ethiopia was found to be 15.9% after using statistical techniques including Cochran's Q and I2 tests to evaluate heterogeneity among the studies. The study highlighted a number of causes that

contributed to OD, including a lack of professional assistance, financial limitations, the use of subpar building materials, poor program execution, and a lack of sanitation awareness.

Abebe and Tucho offer insightful information on the problem of OD and the deterioration of Ethiopia's ODF status. The researchers have made an effort to gather information and gauge the problem's prevalence by thoroughly evaluating the available literature and performing a meta-analysis. But there are some limitations to be aware of. Firstly, the study only examined literature up to June 2019; thus, more current research or advancements may have had an impact on the findings. Second is generalizability issue. Although the study is focused on Ethiopia, it is possible that the results may not be directly transferable to other locations or nations. Also, there is a publication bias for the study. Although the researchers did a crucial assessment of publication bias, the probability of bias in the chosen studies could still have an impact on the overall findings. In addition, there is a lack of qualitative data: Although the study used a mixed-method technique to deal with heterogeneity from qualitative data, a more thorough qualitative analysis could have given a fuller understanding of the variables causing OD. Despite the limitations, the study offers a number of solutions to the problem, but more research and analysis of socio-cultural and economic elements are needed to determine the viability and success of these treatments. The research raises concern about increase in OD in Ethiopia despite some villages having achieved ODF status. The research provides a helpful foundation for understanding the problem, but more investigation and context-specific interventions are required to meet the objectives of sustainable sanitation and successfully address the identified contributing factors.

A supplementary investigation by Belay et al. (2022) examine the spatial and temporal patterns of OD among families in Ethiopia, as well as the factors that contribute to this behavior. The authors

analyze the frequency, geographical spread, and reasons behind OD in Ethiopian homes. OD is a significant problem in numerous Sub-Saharan African countries and is associated with the transmission of pathogens that lead to diarrheal illnesses, primarily impacting children below the age of five. The researchers performed a secondary data analysis using a weighted sample of 16,554 households and data from the 2016 Ethiopian Demographic and Health Survey (EDHS). The researchers employed mixed-effect analysis to examine the patterns of OD throughout a 16-year timeframe (2000-2016) with the aim of identifying the underlying factors. The study utilized adjusted odds ratios and 95% confidence intervals to illustrate the associations between the dependent and independent factors. The concentration index was used to assess income-related inequalities, while spatial analysis was utilized to examine the spatial distribution and prominent clusters of OD.

Belay et al. reported a substantial decrease in Ethiopia's OD rate, which declined from 81.96% in 2000 to 32.23% in 2016. A correlation was found between OD and many individual and community-level factors, such as place of residence, region, community poverty level, media consumption, age, education, marital status, media exposure, economic status, and source of drinking water. The study revealed that OD had a greater impact on households with low incomes, highlighting the presence of wealth-related disparities. Non-random patterns of OD practice have been observed, primarily concentrated in the Afar, Somali, and Eastern Amhara regions.

The study by Belay et al. seems to have been well-conducted, and the conclusions are useful for comprehending the incidence and causes of OD in Ethiopia. However, there are some limitations that impact its findings. The study makes use of EDHS secondary data from 2016. Although this is a reliable data source, the ability to prove causality is constrained by the use of cross-sectional

data. Experimental research or longitudinal data would offer stronger proof of the factors influencing the practise of OD. Additionally, there is sample bias. Although a weighted sample of households was employed in the study, it is important to take into account any potential biases in the original EDHS survey's sampling. The outcomes could be impacted by biases in the selection of the families or underreporting of OD. The study is also hampered by its short time span: The study examined data from 2000 to 2016. It would be advantageous to look at data from more recent years in order to identify any developments or trends relating to OD in Ethiopia. The problem of generalizability is also evident. Although the results are pertinent for Ethiopia, the findings' applicability to other nations or regions may be constrained due to regional, cultural, and socioeconomic differences. Additionally, important factors are lacking. It does not take into account potential institutional or policy-related causes of OD because it concentrates on individual and community-level issues. Such factors might help to provide a more thorough knowledge of the problem. While the study emphasises the need for basic sanitation programmes aimed at underserved people, rural areas, and particular regions, it should go into more detail about the precise interventions and policy suggestions to effectively combat OD. Finally, the paper makes no mention of ethical review or data usage considerations, two critical components of any study involving human beings. Despite these criticisms, the study offers important new information about the rate and causes of OD in Ethiopia. In order to effectively address this public health concern, it underscores the need of sanitation programmes that specifically target at-risk areas as well as the need for additional research and solutions.

Debela et al. (2018) look into Addis Ababa, Ethiopia's sanitation and environmental pollution problems. There are few public toilets in the city, and many people, especially in slum areas, use

on-site facilities and OD. The study makes use of assessments of the contents of pit latrines, soils, and water sources as well as physicochemical and faecal contamination indicators. The findings show extensive faecal pollution in water sources, including deep wells, and severely contaminated soils with the parasitic worm Ascaris lumbricoides. Although the amount of worm ova in pit latrine contents decreases with depth, adequate sludge treatment is still required. In order to better inform policymakers and set priorities for activities to improve urban sanitation, the study aims to increase public awareness of environmental contamination.

The study by Debela et al. (2018) tackles an important topic regarding sanitation and its effects on the environment and public health. The findings put light on the serious health issues in Addis Ababa related to pollution, notably the dangers connected to poor sanitation and faecal waste management. The study might, however, has several limitations. The study gives no information regarding the size of the sample or the representativeness of the surveys that were conducted. The reliability and generalizability of the study could be improved by using a larger and more varied sample. The research also discusses physicochemical and faecal contamination markers, although it doesn't go into detail regarding the analysis's methodology. The reproducibility and validity of the study depend on a thorough explanation of the technique. The report specifies the objective of educating decision-makers and establishing priorities for efforts to enhance urban cleanliness. It does not, however, go into detail about the results of the study's possible consequences. The value of the study would be enhanced with a description of how the research findings can guide interventions and policy decisions. Although the study concentrates on Addis Ababa's sanitation issues, a comparison with other cities or regions dealing with comparable problems could offer further context and insights. Finally, the report fails to acknowledge significant shortcomings in

the data collecting or research methodology. Furthermore, recommendations for future research directions may strengthen the study's impact on the field.

The study concludes by highlighting important problems with sanitation and environmental pollution in Addis Ababa. The study may include more information regarding the methodology, sample size, and representativeness to increase its impact and relevance. The study's overall quality would also be improved by outlining the consequences, offering suggestions, acknowledging its limits, and exploring potential areas for further research.

Ayalew et al. (2018) conducted a study in Northwest Ethiopia on diarrheal morbidity in children under five and its contributing factors. The authors recognize that OD, which makes diarrheal illnesses more contagious and is a widespread issue in the underdeveloped countries. 2014 had a 34.1% national OD rate in Ethiopia (with a rural rate of 37.9% and an urban rate of 8.7%). The goal of the study was to determine the risk factors for diarrheal morbidity in children under the age of five in the Dangla district of northwest Ethiopia in 2016. Utilizing a multistage random sample technique, a community-based comparative cross-sectional study design was used. There were 550 households in the entire sample, 275 of which used OD and 275 of which did not. To examine the data, descriptive and inferential statistics were employed.

Five hundred and twenty-five people were questioned out of the 550 households that were chosen, yielding a 95.45% response rate. The prevalence of diarrhea was reported to be 36.1% in OD kebeles and 9.9% in ODF kebeles (small administrative units). This suggests that areas that implement ODF practices have a decreased prevalence of diarrhea.

The immunization of children was one of the causes of diarrhea in ODF kebeles. Compared to children who were not inoculated, those who were had a lower chance of getting diarrhea. Another

important element was the availability of latrines. A latrine was a protective factor against diarrheal morbidity in homes. Results were also influenced by a lack of water. There is a higher risk of diarrhea when there is a water deficit in a family. Last but not least, the incidence of diarrhea was linked to solid waste disposal. Lower incidences of diarrhea were linked to proper solid waste disposal procedures.

ODF kebeles were shown to have a lower overall prevalence of diarrhea in children under the age of five than OD kebeles. The study emphasized the value of infant immunization, the availability of latrines, water access, and solid waste management methods in lowering the incidence of diarrhea in both ODF and OD regions. The results indicate that to effectively combat diarrheal morbidity, the MoH, line ministries, and developmental partners must coordinate their efforts to increase household latrine utilization, address water shortage issues, and promote proper solid waste disposal practices.

There are a number of limitations to the study, despite the fact that it offers insightful information about the incidence of diarrheal morbidity and its contributing factors in the Dangla district, Northwest Ethiopia. For a community-based study that seeks to make generalizations about a whole district, the overall sample size of 550 households can be viewed as being too small. The statistical power of the study may have been improved, and the findings could have been more accurately interpreted if there had been a bigger sample size. Additionally, the study's multistage random sampling method could add bias. To prevent any overrepresentation or underrepresentation of specific subgroups in the population, it is imperative to guarantee that each round of sampling is really random. The study also uses a cross-sectional methodology, which can only demonstrate relationships but not causality. Because of this, it is difficult to prove a link

between the factors that have been discovered and diarrheal morbidity. Additionally, recall bias may affect the data gathered through interviews, particularly when questions are asked concerning episodes of diarrhea, as respondents could find it challenging to recollect specific instances of diarrhea in their children in the past. The lack of information on the data collection method and its validation in the study may have an impact on the accuracy and validity of the information gathered. A lack of control over confounding factors is another issue. Although the study finds links between certain factors and the likelihood of getting diarrhea, it does not account for any confounding factors, which may have an impact on the findings and how they should be interpreted.

Due to differences in socioeconomic conditions, cultural norms, and hygiene habits, the study is specific to the Dangla district in Northwest Ethiopia and may not be readily generalizable to other locations or nations. Additionally, there may be prejudice in the reporting of OD. Respondents might be reluctant to report engaging in OD since it is widely viewed as bad, which could result in an underestimating of the true prevalence of the practice in the area. Lastly, a longitudinal study design would have allowed for a more thorough examination of the factors influencing diarrheal morbidity and useful insights into the changes of diarrheal morbidity over time.

Overall, the study clarifies the problem of diarrheal morbidity and identifies factors that contribute to it in the particular setting of the Dangla district, but there are a number of methodological issues that need to be resolved in follow-up studies to strengthen the reliability and generalizability of the results.

The study by Abubakar (2018) covers a significant and current topic of OD in Nigeria. Its objective was to investigate the elements that affect and govern the practise of OD in Nigerian homes.

According to the survey, around 25% of Nigerians engage in open defection. Place of residence, geopolitical region, economic status, gender, education level, and ethnicity were identified as factors that influence or predict OD.

Abukakar's study does, however, have several drawbacks. It makes use of 2013 Nigeria Demographic and Health Survey data, which may not be up to date with the most recent research. The prevalence of OD and the factors influencing it may have altered over time given that the data as of 2023 is eight years old. For a more realistic depiction of the existing state of affairs, more recent data would be excellent. Additionally, sampling bias exists. The study is based on a national survey, but it is crucial to make sure the sample is representative and free from any major biases. It is possible that some areas or households are underrepresented, which could affect how broadly applicable the results are. Additionally, the data analysis method has some restrictions. Although the published description does not specifically mention it, the study uses both descriptive and inferential statistics to analyse the data. The study's methodology would be strengthened by providing more information on the assumptions made by the statistical tests utilized. Also lacking is the causation vs. correlation. The study finds links between OD and a number of variables, including a household's residency, geopolitical region, wealth index, household head's education level, ethnicity, and gender. It is crucial to remember that correlation does not inevitably imply causation. These relationships might be explained by underlying factors that were not taken into account in the study. There is also the issue of temporal linkage. The study offers information for a certain time period (2013) but does not investigate the link over time between the cited parameters and the practise of OD. It would be beneficial to comprehend how these elements have changed over time and how they connect to modifications in OD practises. The report does not go

into much detail about the potential effects, but it does address the significance of the findings for environmental and public health. A more thorough examination of the negative effects of OD in Nigeria on human health and the environment, as well as the potential financial consequences of resolving the issue, would be desirable.

Despite these drawbacks, Abubakar's study offers viable advice. To decrease OD, the author advises encouraging households and communities to own latrines and adopting behavioural change programmes. These suggestions are practical but the study's conclusions might have been improved by addressing potential difficulties and barriers to putting these interventions into practise as well as solutions.

Ebimgbo et al. (2019) focused on OD in the rural areas of south-east Nigeria. The authors admit that OD is an increasing public health issue, particularly in rural areas, and is a major contributor to a number of illnesses such diarrhea, typhoid fever, cholera, and stunting. It is also to blame for the alarmingly high incidence of deaths among children under the age of five in Nigeria. In order to evaluate potential implications for social work interventions, the study sought to examine how rural communities in the south-eastern part of Nigeria are aware of the public health issues related with OD.

Fifty-two respondents were interviewed in-depth and in focus groups in the Enugu State local governments of Nsukka and Udenu to gather data for the study. In order to extract important themes and contextual implications from the participant's comments, which were subsequently used as illustrative quotes, the research used thematic analysis. The study's findings showed that despite being aware of the harmful effects of OD on the public's health, individuals of the community still partake in the activity. The absence of adequate restroom facilities in these rural

locations is the main cause of this behavior. This emphasizes the pressing requirement for efficient interventions to deal with this problem. The report suggested a comprehensive strategy to address the issue of OD in rural Nigeria. First, it stressed the need to intensify government efforts to end the practice by building adequate sanitation facilities and putting appropriate legislation into place. The report also advocated for the inclusion of social workers as facilitators in public health advocacy programs and policies. Social workers can be extremely helpful in educating families about the value of having their own bathrooms and in encouraging behavioral shifts toward clean behaviors.

In conclusion, rural communities in south-east Nigeria face serious public health concerns as a result of OD. It is clear that in this situation, information alone will not be enough to influence conduct. To create a healthier and more sustainable living environment for these communities, social workers must actively promote better sanitation practices and aid in the implementation of pertinent regulations. Social workers can considerably reduce OD and the accompanying health hazards by collaborating with local governments and communities.

Although the study offered insightful information about the public health issues associated with OD in rural Nigeria, there are a number of areas that might be improved. The sample size for the study was somewhat limited, consisting of only 52 participants from two particular Local Government Areas (LGAs) in Enugu State. It may not be possible to extrapolate the results to other rural areas or the broader south-eastern region of Nigeria from this small sample size. The study's validity would have been increased by using a larger, more varied sample from other areas. Additionally, the study only uses in-depth interviews and focus groups to get its findings. Although qualitative methods might provide insightful information, the lack of quantitative data may make

it more difficult for the study to demonstrate a direct link between knowledge and OD habits. The study also did not conduct a comparative comparison. It does not contrast OD habits or knowledge levels between rural and urban locations. A comparison would show any differences between the two settings and give a more thorough knowledge of the problem. Additionally, the study makes no mention of how the subjects were chosen, which raises questions regarding possible bias in the selection process. To guarantee a representative and impartial sample, the researchers ought to have specified explicit criteria for participant selection.

The study's findings are relevant to our understanding of the problems with OD's impact on public health. The in-depth analysis of the data, including the major themes and subtleties shown in the participants' comments, is lacking, nevertheless. While the report suggests social workers be involved in the fight against OD, it makes no mention of how feasible or effective this strategy would be. Such a recommendation would necessitate considerable cooperation and funding, which the report does not address. The study's recommendations also mainly emphasize enlisting social workers and bolstering government initiatives. To eliminate OD, however, other players, including local communities, NGOs, and private groups, should also be taken into account. Finally, the study's shortcomings, such as potential biases, the accuracy of the data, and difficulties encountered during the research, are not sufficiently discussed. Additionally, it might have offered directions for additional study to delve deeper into the issue.

Overall, the study adds to our understanding of the problems with OD in rural Nigeria, but it could stand to have its methodology, sample size, representation, and level of analysis improved. By addressing these issues, the study's validity would be improved, and more substantial insights would be provided to help direct efficient solutions.

Osumanu et al. (2019) examine the social and economic aspects that contribute to OD in Ghana's Wa Municipality. A mixed method approach is used to gather information from 367 homes that were carefully chosen from 21 neighbourhoods. This includes administering questionnaires, making observations, and conducting key informant interviews. The mixed model is used in the study to pinpoint the variables that have a significant impact on OD. It is discovered that about half of the households lack a toilet facility at home, forcing them to use public or shared restrooms or engage in OD. There are six factors that are proven to be positively significant in predicting OD: education, home size, occupation, income, traditional norms and beliefs, and possession of a toilet facility. The study comes to the conclusion that in order to solve OD, sociocultural and economic barriers that prevent households from using or having access to toilet facilities must be understood and removed.

Osumanu et al. give relevant policy implications and delivers insightful information on the elements influencing OD in the Wa Municipality. Some areas of the study, however, might be improved upon and addressed. The small sample size is the first problem. The sample size of 367 homes, despite the study's use of both probability and nonprobability sampling approaches, may be too small to accurately reflect the variety of viewpoints and practises found throughout the entire Wa Municipality. A greater sample size might have improved the findings' generalizability. Data collecting is the second problem. The study depends on self-reported data from questionnaires, which could contain recollection flaws or social desirability bias. The subjective interpretation of the researchers may also affect observations and interviews. The credibility of the conclusions would have been improved by triangulating data from different sources and methodologies. The issue of association vs causation is another. The study identifies risk variables

for OD but does not prove that they cause it. OD may be connected with some criteria, such as money and education, but not always directly caused by them. The study also lacks a thorough qualitative examination. Even though the study uses qualitative techniques like interviews, the qualitative analysis is somewhat constrained. The comprehension of the sociocultural factors favouring OD might have been enhanced by a more thorough explanation of qualitative findings. In terms of policy suggestions, the report recommends new and creative methods for public education and credit financing to help households build home toilets. It does not, however, provide particular information on how these ideas might be put into practise or on potential difficulties that might develop. The study's conclusions and its policy ramifications may not immediately apply to other locations or nations with distinct sociocultural circumstances, despite the fact that the Wa Municipality is the study's primary emphasis. The study's external validity would be improved by taking into account the variety of cultural practises found in Ghana and other developing nations. Osumanu et al. were able to highlight important aspects of OD in the Wa Municipality despite their constraints. It emphasises how crucial it is to remove social and economic obstacles in order to advance sanitation practises. However, it would be advantageous to increase the sample size, employ rigorous data collection techniques, give more in-depth qualitative analysis and useful implementation plans for policy suggestions in order to reinforce the study's findings and implications for policy.

Mensah et al. (2021) performed a study on the effects of OD on Ghana's sustainable tourism and heritage management. The authors acknowledge that access to better sanitation is a key objective of the sixth SDG. Apart from its advantages for the environment and the general population, good sanitation is crucial for preserving heritage monument sites' Outstanding Universal Value (OUV)

and fostering environmentally friendly travel. The study focused on the effects of OD on sustainable tourism and heritage management while examining the causes and consequences of OD near a World Heritage (WH) site in Ghana.

The study used a qualitative methodology to gather information from a variety of intended respondents. They consist of an environmental health officer, heritage managers, a tourism specialist, hoteliers, Zoomlion staff, open defecators, community opinion leaders, and regular community members. Thematic analysis was used to examine the data in order to find significant patterns and insights.

Mensah et al. identified a number of root causes of OD in the neighborhood around the heritage site. The primary causes included lack of toilet facilities in many homes, unsanitary and unpleasant public latrines, a lack of respect for heritage culture and poor attitudes, poverty, insufficient sanitation education, and a lax enforcement system for sanitation laws. The sustainability of heritage tourism and the livelihoods of those who depend on it are seriously threatened by the prevalence of OD. Additionally, it jeopardizes the heritage monument's authenticity and integrity, which ultimately reduces its Outstanding Universal Value. The study's findings led the authors to suggest a number of workable solutions to deal with the issue of OD and its detrimental effects on heritage preservation and sustainable tourism. They suggested that to design and implement a comprehensive environmentally friendly plan, local, national, and international stakeholders must work together in the first step. Delineating the limits of the historical resource, routinely inspecting the protected area, strictly enforcing the sanitation laws, and conducting extensive campaigns to educate the public about sanitation should all be prioritized. They also advised to build decent restrooms close to the monument for the benefit of the traveling public. It is possible to guarantee

that every household has access to suitable sanitation facilities by using the CLTS approach. Digital cameras can be installed in key areas of the heritage site's buffer zone to catch offenders, who should then face harsh penalties, in order to discourage OD.

The study's conclusion highlights the importance of sanitation at heritage sites in developing nations and calls on the World Heritage network to continue talking about how to manage sustainable tourism and heritage conservation. The research aims to promote proactive measures that protect both public health and the preservation of heritage monuments by illuminating the issue of OD and its effects on cultural heritage and tourism. Heritage site managers can work toward the SDG goal of improved sanitation by putting the suggested pragmatic solutions into action while also ensuring the long-term viability of the site's cultural and tourist resources.

Mensah's study does, however, have a number of drawbacks, including a lack of rigorous methodology. Although the study used a qualitative methodology, it would have been advantageous to also include quantitative data to provide a more thorough analysis of the problem. The study's overall validity could have been improved by the statistical insights that quantitative data could have provided, supporting the qualitative findings. Additionally, the study employed purposive sampling, which could have influenced the results. For instance, relying on respondents like hoteliers and tourism experts could skew the results in favor of particular viewpoints while potentially ignoring other important perspectives from the local community or marginalized groups. Additionally, the study was restricted to one Ghanaian World Heritage site, which limits the generalizability of the results. Multiple Ghanaian heritage sites or even heritage sites in other nations could have been compared, taking into account regional differences in sanitation practices and their effects on tourism. The study also has a problem with the causality vs. correlation debate.

The study identifies reasons why OD occurs close to the heritage site, but it does not prove causality. Differentiating between elements that directly contribute to OD and those that merely correlate with the practice is crucial. Additionally, the study's contextualization is inadequate. The socio-cultural and economic contexts of the neighborhood surrounding the heritage site are not explored in depth. Understanding these elements is essential to understanding OD's underlying causes and the difficulties in promoting sanitation. Additionally, the study offers only a narrow view of sustainable tourism. It primarily focuses on the detrimental effects of OD on heritage preservation and tourism. Even though this is important, it ignores the potential benefits of sustainable tourism in dealing with sanitation issues and promoting community development. The study's lack of longitudinal analysis is yet another drawback. Although it gives a snapshot of the current state of affairs, a longitudinal viewpoint is needed to evaluate long-term trends in OD and the efficacy of potential interventions. Additionally, the study uses sensitive information about OD and could raise moral questions about respondents' privacy and dignity. These issues should have been covered in the study along with the steps taken to safeguard participant rights. The study only briefly discusses heritage conservation in its final section. It mainly discusses the effects of OD on tourism, but a more thorough discussion of the impact of such practices on the long-term preservation of the heritage site would have been beneficial.

As a result, even though the study tackles a crucial problem related to sanitation and heritage management, it has some flaws that could have been fixed to improve its overall applicability. The study's impact and potential to influence effective interventions could have been increased with a more thorough and diverse approach to data collection, better contextualization of the problem, and a wider discussion of sustainable tourism and heritage conservation.

Delaire et al. (2022) studied the viability of CLTS in Ghana. The purpose of the study was to evaluate the effectiveness of CLTS initiatives in Northern Ghana's rural areas in reducing OD. Achieving ODF status in communities is a common goal of CLTS, a strategy that is popular in low-income nations for promoting sanitation and hygiene. However, it was unclear how long-term benefits in toilet ownership and usage would be sustained by CLTS. The study looked at 109 rural villages in Northern Ghana to see how well toilet ownership and use had been maintained two and a half years after receiving ODF designation.

The study used a cluster-randomized controlled trial (cRCT) design, which had three phases: gathering baseline data in 2019, putting targeted sanitation subsidies in place in 2020, and gathering post-intervention data in 2020–2021. The neediest homes were determined through community consultation, and they received free toilet substructures (pit lining and slab) as a result of the targeted subsidies. 109 communities were randomly chosen to participate in the study, which was conducted in Ghana's Tatale and Kpandai districts. Enumerators sent questionnaires in local languages to households and community leaders during the survey period of March to June 2019. 3,385 different compounds housing a total of 5,615 households were included in the study.

The results indicated that a significant proportion of communities (75%) did not comply with Ghana's OD and ODF legislation, despite being officially certified as ODF. 25% of households reported a high occurrence of OD, and almost one-third of these households either never had (16%) or no longer had (24%) a working toilet. The collapse of the pit latrine and superstructure were the primary factors leading to the resumption of OD. The study found that certain factors, such as being located at a greater distance from important roadways, having soil that is not rocky, implementing a system of fines to discourage OD, and achieving ODF status more recently, are

linked to better toilet coverage. Households with a larger number of family members, higher wealth, a male head of household without a primary education, no children under the age of five, and involvement in the Livelihood Empowerment Against Poverty (LEAP) program were more likely to have a working toilet.

The study's findings suggest that interventions targeting the issues of toilet collapse and rebuilding difficulties, especially among the most impoverished households, have the potential to enhance the long-term sustainability of sanitation gains led by CLTS in rural Ghana. The study suggested that in order to avoid significant relapses, post-ODF treatments should commence within the first year after achieving ODF status. Possible strategies to enhance the longevity of toilets include the establishment of markets for durable and superior quality toilets, as well as the provision of financial alternatives such as loans and targeted subsidies.

The study's overall findings emphasised the significance of ongoing evaluation and focused interventions to guarantee the long-term success of CLTS programmes in reducing OD and enhancing sanitation in rural areas of low-income nations like Ghana.

The study has some shortcomings and need for development, despite the fact that it offers insightful information about the viability of CLTS interventions in rural Northern Ghana. First off, the study's two and a half-year time span could not be long enough to fully reflect the durability of CLTS treatments over the long term. Longer time frames are frequently needed to evaluate the full efficacy of infrastructure maintenance and sanitation behaviour modification. Second, a cluster-randomized controlled trial (cRCT) design was used for the study, but only communities that had already been designated as ODF before 2019 were considered. This selection might be

biased and may not accurately reflect the full variety of communities that either attained ODF status before 2019 or did not. Third, there is no control group in the study's design to compare sustainability results to communities that did not receive CLTS interventions. It becomes difficult to ascribe changes only to CLTS interventions and exclude the influence of other factors in the absence of a control group. The study also extensively relies on self-reported data, which could introduce social desirability bias. Due to societal pressure or fear of consequences, households may overestimate or underreport their adherence to ODF rules. Prior to applying targeted subsidies, the study gathers baseline data, but it does not offer details on the intervention's effects. In order to assess how well subsidies, support sanitation improvements, it is essential to comprehend their impact on toilet ownership and usage. Additionally, the study primarily focuses on quantitative analysis, ignoring the richer insights that qualitative data can provide into the causes of toilet collapse, difficulties associated with behaviour modification, and community dynamics affecting sustainability.

Another drawback is that because the study was limited to a few rural districts in Northern Ghana, the results might not be completely transferable to other areas or nations with diverse socioeconomic, cultural, and environmental circumstances. Additionally, the study does not take into consideration outside variables that can affect the sustainability of sanitation gains, such as governmental policies, shifts in socioeconomic situations, or the impact of other non-CLTS sanitation measures. Additionally, because the data were gathered at a specified period, seasonal variations or long-term changes in behaviour and environment may not have been captured. The study does not go in-depth into the underlying behavioural and social elements that influence

persistent toilet use and the practise of OD, despite the fact that it emphasises issues with toilet infrastructure.

In conclusion, the study adds important knowledge on the difficulties rural Northern Ghana encountered in maintaining sanitation advancements after obtaining ODF status. To further understand the dynamics of behaviour change and the long-term durability of CLTS interventions, more thorough, longitudinal research involving a larger range of communities and deeper qualitative analysis is required. The study's robustness and generalizability would also be improved by include control groups and taking into account outside factors.

Alhassan and Anyarayor (2018) explored the adoption of sanitation innovations in the Nadowli-Kaleo District of the Upper West Region of Ghana as part of attempt to achieve ODF status. Less than half of the families in the district embraced the ODF innovations that were introduced as part of a CLTS programme that was in place at the time of the study's implementation. The factors impacting continued use of the innovations were investigated, and the researchers also looked into the causes for the different rates of acceptance among community members. They also looked into how sustained adoption affected the neighbourhood. The study's research style was qualitative, and it especially used a phenomenological approach to examine respondents' experiences with and impressions of the district's implementation of CLTS as a new sanitation strategy. In the Nadowli-Kaleo District, information was gathered from 252 families across seven area councils utilising interviews, non-participant observation, and key informant interviews. The study's conclusions showed that while widespread awareness of innovations was increased by effective communication, households' ability to maintain and use latrines was severely hampered by low income levels. Benefits to security and health, as well as privacy's comfort and dignity, were

additional elements that contributed to sustainable adoption. Resistance to the adoption and sustainable usage of ODF innovations was also influenced by cultural views. According to the study, to alter attitudes after raising awareness, future ODF programmes built on the CLTS module should enhance behaviour change communication (BCC) tactics include interpersonal communication, mass media, and role-playing. Additionally, it recommended working with traditional leaders to lessen opposition and advance acceptance through education.

Alhassan and Anyarayor offered insightful information about the variables affecting the adoption of sanitation innovations in the Nadowli-Kaleo District. By thoroughly examining respondents' experiences and perspectives, qualitative research methodologies enabled a more nuanced understanding of the problems. However, there are some limitations to take into account. Although the study employed a multi-stage sampling technique, the sample size (252 respondents) might not accurately reflect the district's range of viewpoints. The results might not apply to areas or populations in other countries or with different cultural origins. Even though the study included a variety of data collection methods, including interviews, observations, and key informant interviews, the use of a Likert Rating Scale for several questions may have constrained the depth of responses. As with any qualitative study, the data collection and analysis could have been influenced by the researchers' biases and subjectivity, potentially influencing the findings' impartiality. The study also concentrated on identifying variables that affected adoption at a particular period. The long-term impacts of persistent adoption and the shifting dynamics over time would have been better understood with a more longitudinal approach. Additionally, the study's primary method of data analysis was descriptive statistics. The conclusions may have been strengthened and the significance of many aspects could have been tested using a more thorough

quantitative investigation. The study did not include a comparison group of communities that did not take part in the CLTS programme, even though it looked at sustained, unsustainable, and non-adopter groups. This might have offered further information on the program's efficacy.

The study by Alhassan and Anyarayor provides important insights into the application of sanitation innovations in the Nadowli-Kaleo District. However, future study may use a bigger and more varied sample, combine qualitative and quantitative methodologies, and take a longitudinal view to improve its application and robustness. The credibility of the study would also be improved by eliminating potential biases and guaranteeing openness in the research process.

Nzouebet et al.'s (2019) study sought to evaluate on-site sanitation facilities in Yaounde, Cameroon, using eight factors related to hygienic safety, sustainability, and functionality outlined in the MDG target 7 for improved sanitation. Through semi-structured interviews and observations of 602 randomly chosen toilet facilities in 22 distinct urban settlements of Yaounde, the researchers gathered data on toilet facility design, management, and functionality. Additionally, they gathered information on the socioeconomic standing, management, and operation of the restrooms, as well as the users' health.

The study's findings showed that Yaounde employed a variety of excreta disposal practises, with about 3% of homes using OD in the absence of latrines. The majority of latrines (79%) had concrete slabs covering the top, and 69% had ground lining beneath the floors. Orally transmitted infections connected to sanitation were shown to be more prevalent during the rainy seasons in households without sufficient toilet facilities.

In order to provide adequate sanitation and a healthy environment, the study advised management changes for the sanitation facilities in a few Yaounde localities based on its results. In order to

address the public health issues associated with poor sanitation in the city, it is suggested that better sanitation infrastructure, expanded access to appropriate lavatory facilities, and improved sanitation practises be implemented.

The study had a number of shortcomings, despite the fact that it offers insightful information about Yaounde's on-site sanitation facilities. First, it is possible that the study's sample size of 602 restrooms among 22 villages is insufficient to fully represent the variety and complexity of sanitation circumstances in Yaounde. Additionally, bias could be introduced throughout the settlement selection process, which could result in non-representative outcomes. Second, the study's semi-structured interviews and observational methods may have been exposed to interviewer subjectivity and prejudice. Additionally, householders' self-reporting may result in inaccurate statistics, particularly when it comes to delicate topics like sanitation practises. Third, because there was no comparison group or control group in the study, it was difficult to assess if Yaounde's sanitation conditions were considerably better or worse than those in other cities or regions.

The study also assessed sanitary facilities using indicators for MDG target 7. It is possible that not all aspects of sanitation are covered by the indicators. A larger range of indicators that take into account aspects like accessibility, privacy, and gender-specific demands would be beneficial for the evaluation. Additionally, it appears that the study is cross-sectional, giving a picture of the sanitary conditions at a specific moment. To discover trends and modifications in sanitary facilities over time, a longitudinal analysis would be more instructive. The socioeconomic level of households is mentioned in the study, but its effects on sanitation practises and conditions are not fully addressed. The association between socioeconomic characteristics and access to adequate

sanitary facilities may have been more thoroughly examined. The study did not prove a connection between inadequate sanitation facilities and diseases associated with poor sanitation. The occurrence of diseases may also be influenced by other factors like personal cleanliness habits, access to clean water, and general health practises. Lastly, while the research makes general suggestions for enhancing sanitary services in some areas, it does not offer any detailed implementation plans. For legislators and local governments, advice on how to enhance management and accessibility would be helpful.

Future studies could take into account expanding the sample size, using more exacting data collection techniques, and carrying out longitudinal research to monitor changes over time in order to address these criticisms. The study's findings might be strengthened if socioeconomic factors were examined and causal relationships between sanitation conditions and health outcomes were established. Moreover, offering more specific and individualised advice for various settlements could aid in converting research findings into workable solutions for better sanitation in Yaounde. Maliti (2020) focuses specifically on Tanzania's OD problem, which is a major health-related development concern in many poor countries. According to the researchers, OD rates have been declining in Tanzania. Notably, the progress made has been pro-poor, meaning that it has predominantly benefited the population's lower socioeconomic groups. Despite these changes, the survey shows that OD practises still predominate in certain areas of the nation, particularly in the lake zone and north-eastern regions. The study reveals a number of important variables that affect OD practises, including money, age, rurality, and education.

According to Maliti, it cannot be emphasized how crucial safe and better sanitation facilities are to the general health and welfare. Improved sanitation also controls the spread of "neglected

tropical diseases" such intestinal worms, schistosomiasis, and trachoma and diarrhoea risk is reduced. Additionally, having access to better sanitation results in significant improvements and savings. For instance, it is predicted that better sanitation and hygiene conditions might yearly save 800,000 lives worldwide. Additionally, every individual who relieves themselves in public could save 2.5 days annually, freeing up more time for other useful pursuits. Additionally, spending money on water and sanitation provides a significant return on investment, with every dollar spent yielding a profit of US$11 in terms of saving money on lost productivity, education, and healthcare expenses.

Maliti's work seeks to answer two important research concerns by utilizing data at the national level from four successive rounds of Demographic and Health Surveys (DHS). The first inquiry looks at whether there has been a long-term shift in the regional concentration of OD practises. The results show that even though families without sufficient toilet facilities have been less common overall, OD is still more common in some areas. Over the years, these localities, which are primarily in the lake zone and northeast, have made only little progress in eliminating OD practises.

Maliti's (2020) second research question subject is understanding how socioeconomic traits affect OD practises and whether these factors are changing over time are the. According to the study, OD practises can be explained in large part by factors such as money, age, rurality, and education. It is noteworthy that wealth has become more important over time, showing that economic variables are now more important in determining whether a household practises OD. The impact of rurality, on the other hand, is waning.

In conclusion, the report highlights Tanzania's progress in addressing OD while also outlining the issues that still exist in some areas and socioeconomic classes. The findings highlight the significance of addressing economic inequities and have policy implications for targeted interventions in areas with high prevalence. The report also emphasises the global significance, which is in line with the 2030 SDGs' goal of ensuring that everyone has access to sufficient and equitable sanitation and hygiene, as well as ending OD. However, the study's shortcomings, such as its data breadth and lack of examination into causality and treatments, call for additional research to create more thorough tactics to effectively address OD. The study also highlights the need for greater comprehension of pastoralist nomadic groups and the political economic dimensions of sanitation-related problems in order to inform effective policy decisions. Overall, the study offers important new perspectives to the ongoing campaigns in Tanzania and elsewhere to end OD and enhance public health and wellbeing.

The study by Maliti (2020) has a number of advantages and offers insightful information on the problem of OD in Tanzania and the variables influencing it. This study is extremely relevant and crucial since OD is a huge public health and development concern in many developing countries. Additionally, the study makes use of data from the census as well as the Demographic and Health Surveys, giving a complete picture of the prevalence of OD and its causes throughout time. The study also outlines the problems that remain as well as the advancements made in Tanzania's fight against OD. It highlights the necessity of focusing interventions on certain geographic areas and socioeconomic categories. Lastly, the study supports the UN SDGs, especially SDG6 which emphasises water and sanitation, underscoring its importance on a worldwide scale.

Maliti's study does, however, have a few limitations. Given that the study is a critique, it is crucial to take into account any updates or new patterns that may have developed since the study's usage of data up to 2015 was conducted. While the study identifies risk factors for OD, it may not investigate causal linkages or assess the efficacy of particular measures to stop it. In order to comprehend the underlying social and cultural elements promoting OD, the study also uses logistic regression and descriptive analyses, but it may benefit from additional qualitative research or mixed-method techniques. Additionally, although acknowledging the need for improved comprehension and interventions for nomadic pastoralist groups, the study does not go further into their unique problems and potential answers. Finally, the study makes the case that it is crucial to comprehend political motivations and incentives in order to prioritise sanitation-related issues, but it does not fully address these political economic facets.

In summary, the study sheds important light on the problem of OD in Tanzania and how its frequency and drivers have changed over time. While it emphasises development and policy consequences, there are also some areas that need for greater research and possible modifications to take into account more recent advancements. Overall, it makes a significant contribution to our knowledge of and solutions for OD in underdeveloped countries.

Based on this review, it was found that the sustainability of CLTS outcomes is higher in areas where there is a supportive enabling environment. This includes factors such as regular follow-up visits, communities that have access to latrine products and materials through the market, government support, and socially cohesive communities (Garn et al., 2016). The research objective is to gather empirical data on the long-term impacts of sanitation programs, as there is a scarcity of studies that examine the durability of any form of sanitation (Waddington et al., 2009). Two

studies, one conducted five years after a project to provide latrines in Bangladesh (Hoque et al., 1996) and the other conducted 2 to 9 years after initiatives to promote latrine usage in eight different countries, have reported sustained latrine use following sanitation interventions (Cairncross, 2004).

There is a scarcity of journal-published studies on the duration of CLTS results. Approximately two to four years following the completion of CLTS and the certification of communities, three studies conducted using grey literature (material not published in scientific journals) provide information on the outcomes of sanitation efforts and the rates at which communities revert back to OD (Mukherjee et al., 2012). Cavill et al. (2014) conducted a study that examined unpublished literature on the state of ODF areas. The study extensively discussed the elements that contribute to and restrict the long-term success of ODF initiatives. However, the study also acknowledged the challenges of generalizing findings due to methodological limitations in the numerous studies. The STBM program, including of five core components aimed at eradicating OD, encouraging proper hand hygiene with soap, enhancing home water and food handling practices, and effectively managing solid and liquid waste, strictly conforms to the principles of stimulating the desire for improved sanitation in communities. As a result of these measures, more than 9000 communities in Indonesia have successfully achieved the first pillar of halting OD. The current surveillance systems, similar to those in most nations in this region, lack the capability to document the activities taking place in these ODF settlements over an extended duration. In order to ensure the success of post-ODF programming and the complete elimination of OD as per their national objective, it is crucial to have a comprehensive understanding of ODF sustainability and the intricacies of societal norms (Cavill et al., 2014).

These efforts have resulted in over 9000 verified ODF villages (i.e., achievement of the first pillar to stop OD) in Indonesia. However, like most of the countries in this region, the current monitoring systems cannot capture what happens in these ODF villages longer-term. A better understanding of ODF sustainability and the dynamics of social norms is critical for informing sound post-ODF programming and for ensuring the elimination of OD as per their national target. Same comments on citation (Cavill et al., 2014).

### 2.3.3: Kenya's Situation in ODF/CLTS

Kenya is one of the nations that fell short of the Millennium Development Goal (MDG) of ensuring that everyone has access to clean water and sanitation. Only 30% of Kenyans are able to use modern sanitation facilities, which hygienically separate human contact with excrement (Ndungu, 2018). This indicates that around six million Kenyans are defecating in the open and that around 30 million still use harmful sanitation practices, such as primitive types of latrines (Ndungu, 2018). The rate of rise in access to better sanitation is concerning, even though this number is larger if shared facilities are taken into account. Only 5% more Kenyans now have access to better sanitation between 1990 and 2015 (Ndungu, 2018).

In 2011, the MoH in Kenya started a statewide community-led complete sanitation program with the goal of achieving ODF status. A roadmap was created for rural areas in Kenya from 2011 to 2013 with the goal of obtaining ODF status by 2013, as stated in the MoH Report of 2013. The government had to revise its roadmap to achieve ODF status in Kenya by 2020 because the initial target was not met. However, as of 2013, out of the 59,915 villages in Kenya, only 9,126 villages (15%) had been triggered, 3,956 (7%) claimed ODF status, with only 2,567 (4%) verified and a

disappointing 1,273 (2%) ODF certified, according to the WHO Report in 2015. (WHO Report, 2015).

The UNICEF further revealed that access to improved sanitation for both rural and urban was at 31%, unimproved sanitation at 30%, and OD at 12%. This means, therefore, that over 8 million Kenyans still practice OD resulting in water-related diseases like diarrhoea, amoeba, cholera, and typhoid. In addition, poor sanitation practices have been estimated to cost these counties losses of about Ksh 27 billion annually (WHO/UNICEF, 2015).

In 2019, Njuguna assessed Kenya's progress toward being an ODF nation. The study's main concern was OD in Kenya, where an estimated 14% of people engage in this unhygienic activity. OD has been linked to poverty, which is a significant contributing factor. Kenya wants to be 100% rid of OD by 2030, which is in line with SDG number 6. With a focus on impoverished households in particular, the study sought to examine the progress made in achieving this objective at the household level.

Njuguna (2019) conducted three nationwide household surveys in 2003, 2008, and 2014, and their data were examined by the researcher. To investigate the link between several variables and the presence of OD, he employed descriptive analysis and bivariate logistic regression. OD was the dependent variable, and the independent factors were gender, household head's educational degree, place of residence, region, and lack of farm animals. Pit latrines without a slab were discovered to be the most popular sanitation technology nationwide, with prevalence rates in the study years ranging from 35.9% to 37.9%. OD decreased in frequency from 16.2% in 2003 to 9.9% in 2014.

Notably, 81.8% of households that used OD in 2003, 86% in 2008, and 96% in 2014 were categorized as poor.

The most important predictors of OD, according to the study, were poverty, the educational degree of the household head, and living in a rural location. The odds ratios for poverty as a predictor of OD were 9.4 (95% CI: 7-12.6) in 2003, 9.4 (95% CI: 6.6-13.5) in 2008, and 29.2 (95% CI: 23.3-36.8) in 2014. This data shows that impoverished families had significantly greater risks of OD. The survey found that the wealthiest families shown a favorable trend in their sanitation practices, moving from utilizing pit latrines with slabs in 2003 to flush toilets connected to sewage systems in 2008 and 2014. With the transition from pit latrines without slabs in 2003 and 2008 to pit latrines with slabs in 2014, the wealthier households also improved their sanitation practices. The majority of middle-class and lower-income homes, however, did not change at this time and continued to utilize pit latrines without slabs. There hasn't been much improvement in the sanitary conditions in the poorest households, as seen by the persistence of OD.

According to the study's findings, OD is now more common among Kenyan impoverished households, especially the poorest. Poor households did not make as much progress as non-poor households did because they transitioned out of OD more quickly. According to the study, it is crucial to focus interventions on helping impoverished households attain ODF status by 2030. Effective progress in ending OD in Kenya can be made by concentrating on reducing poverty and providing these vulnerable households with better sanitation facilities, education, and support services.

There were some noticeable limitations, despite the fact that the study offers insightful information about the prevalence of OD in Kenya and its connection to poverty. The study concentrated on poverty as the primary factor predicting OD. Although the study ignored other potential drivers like cultural customs, understanding, and access to sanitation facilities, poverty is unquestionably a significant factor. The factors driving OD might be better understood with a deeper analysis and a wider variety of variables. Additionally, the study used cross-sectional data from household surveys, which hinders its capacity to pinpoint the exact causes of OD and poverty. It is impossible to say if OD directly results from poverty or if both OD and poverty are caused by the same underlying issues. For proving causal linkages, longitudinal or experimental approaches would be preferable. Additionally, there are situations when the precision and dependability of data from household surveys might be called into doubt. Data collection techniques, survey response rates, or steps taken to guarantee data quality were not included by the study. The validity of the study's findings may be impacted by several elements.

Additionally, the report acknowledged the need to focus interventions on helping impoverished households but avoided discussing any particular programs or laws that would be successful in lowering OD. The study's recommendations should be strengthened by investigating effective sanitation initiatives in different settings and assessing how they can apply to Kenya. The study made a point of highlighting geographical differences in OD prevalence, but it did not do so in great detail. Knowing how OD rates vary by location could help identify problems and suggest chances for specialized solutions. Additionally, the study ignored the behavioral and cultural aspects of sanitation practices in favor of concentrating primarily on the socioeconomic factors linked to OD. Sanitation-related cultural norms, beliefs, and attitudes can have a big impact on

how people behave both individually and collectively. A more complex understanding of the issue would result from incorporating these factors into the investigation. In this study, information from three household surveys conducted between 2003 and 2014 was examined. Even though it might reveal certain patterns, this might not account for long-term changes or anticipated variations in OD rates over time. Lastly, the study only used quantitative data and excluded qualitative data from focus groups or in-depth interviews with people of the community. A deeper comprehension of the attitudes and experiences associated to sanitation methods may be provided by using qualitative data. The study's thoroughness and the recommendations for successful initiatives to reduce OD in Kenya might both be strengthened by addressing these weaknesses.

Nyoni and Nyoni (2020) carried out a study to forecast the decline of OD in Kenya. The study made projections regarding the number of persons projected to continue practicing OD throughout the period from 2018 to 2021 using annual time series data on the prevalence of OD in Kenya from 2000 to 2017. For their investigation, the researchers used the Box-Jenkins ARIMA (AutoRegressive Integrated Moving Average) approach. The OD series was identified as an I (1) variable by diagnostic testing, which means differencing is necessary to establish stationarity. The ARIMA (0, 1, 2) model was determined by the study to be the most suitable for predicting based on the Akaike Information Criterion (AIC).

The ARIMA (0, 1, 2) model's diagnostic tests showed that it is stable and that the residuals are stationary at the levels. As a result, the model may be trusted to estimate how common OD will be in Kenya in the future. Over the course of 2018 to 2022, fewer people in Kenya are expected to

practice OD, according to the study's findings. In particular, it was anticipated that during this time the prevalence would drop from almost 9.9% to nearly 8.2% of the overall population.

The report made three policy recommendations for the Kenyan government to take into consideration based on its findings. First, the government needs to make measures to upgrade sanitation infrastructure a top priority. To encourage people to stop using OD, this involves building suitable restrooms and sanitation facilities. The report also made the case for public education efforts about the hazards of OD for human health and the ecosystem. Increasing public knowledge can encourage behavioral change and lower the occurrence of OD. The study also suggests pursuing targeted treatments in regions where OD is more prevalent. These interventions could consist of funding for sanitary facilities, educational initiatives, and community organizing.

The analysis came to the conclusion that OD in Kenya was likely to reduce marginally between 2018 and 2022 based on the projections made by the ARIMA (0, 1, 2) model. By 2030, OD might be entirely gone in Kenya if the suggested policy proposals were put into practice. These results can be a useful resource for decision-makers and other sanitation sector stakeholders as they develop plans to tackle this important public health issue.

Nyoni and Nyoni study has limitations, even though it offers useful insights into the forecast of OD in Kenya using ARIMA methodology and offers policy recommendations. The study lacked a thorough justification of the applied Box-Jenkins ARIMA approach. The work would have been more transparent and reproducible if the procedures for choosing the model and processing the time series data had been described in greater detail. Second, the study used annual time series data from 2000 to 2017, which would not accurately reflect current changes in OD patterns or

short-term oscillations. The study's predictions might have been more accurate if a longer time series had been used, or if more recent data had been used. The ARIMA model was also deemed to be the best fit for the data in the study. Other forecasting techniques, however, may have been investigated to confirm the results. The study also failed to address the drawbacks of the ARIMA methodology, including potential model misspecifications and the sensitivity of the findings to model assumptions.

The study also indicated that OD will decrease from 2018 to 2022, but it also raised the prospect that it would end by 2030. The relationship between the 2022 predictions and the 2030 objective is not clear, and a clearer description of the timing would have been helpful. Additionally, the study lacked a full examination of the factors driving OD and was primarily concerned with prediction. It could have been easier to create more focused and efficient policy recommendations if we had a better understanding of the causes of OD. Although the report offered policy recommendations, it did not discuss the probable difficulties and viability of putting these policies into practice. Practicality requires taking into account the economic, political, and social elements that affect how policies are implemented. The study concentrated on OD behaviors in Kenya, hence its conclusions might not be readily transferable to other locations or nations with distinct sociocultural and economic situations. The authors ought to have talked about the applicability of their findings and their consequences in different contexts. A validation procedure to evaluate the accuracy of the ARIMA model's predictions against out-of-sample data was also absent from the study. To ascertain how effectively the model operates in actual circumstances, validation is crucial. Lastly, questions concerning the study's validity and dependability are raised by the

absence of any mention of peer review or publication information. Peer review contributes to the validity and reliability of research findings.

In conclusion, the study offers intriguing policy suggestions and forecasts regarding OD in Kenya, but it also has several flaws, such as limited data, unclear methodology, and the lack of in-depth analysis and validation. By addressing these problems, the study's scientific validity and practical applicability would have been improved.

Aluoch et al.'s (2020) study sought to identify the variables causing Suna West Sub County, Kenya, to revert to its ODF status in spite of the adoption of CLTS interventions. Although CLTS has been widely utilized to encourage behavior change linked to sanitation and reach ODF status, it has significant rates of reversion, making it unsustainable in many circumstances.

The researchers employed a survey study design, including questionnaires and observation checklists to gather information from 384 houses in the study area. 66.1% of households experienced a partial reversion to a non-ODF status, according to the findings. According to the study, certain sanitation-hygiene procedures are necessary for maintaining ODF status. These procedures include using treated water, elevated racks, routine latrine cleaning, pouring ash over latrine pits, and using dug-out pits for waste disposal. It was discovered that these procedures increased the likelihood that households would keep their ODF status. Conversely, a lower likelihood of households keeping their ODF status was connected to specific social norms. These included the presence of rules or punishments, the belief that family circumstances needed to be bettered, and prizes or incentives. A household's likelihood of maintaining ODF status was also

lower if it believed that construction and maintenance supplies were expensive, that most people lacked latrines, and that urinating in bushes, rivers, or dams was acceptable.

The study's findings showed that while ODF status reversal was visible in villages that had previously received certification, specific sanitation hygiene activities helped households maintain their ODF status. It's interesting to note that households adhering to particular social standards were less likely to keep their ODF status. This shows that the CLTS approach had minimal impact on long-lasting behavior change because it was unable to develop social norms that encouraged proper hygiene and motivated community cooperation. Based on these findings, the study recommended that in order to foster long-lasting behavior change in sanitation practices, it is necessary to improve excellent hygiene sanitation practices and to instill social norms that encourage community collective action.

The study has a number of limitations, despite the fact that it offers insightful information about the variables influencing the ODF status in Suna West Sub County, Kenya. First off, the study's sample size of 384 houses might not be adequate to draw broad conclusions about Suna West Sub County's total population. For the study's conclusions to be applicable to a wider context, a bigger and more representative sample should have been used. Second, the study made use of survey tools like questionnaires and checklists for observations. Although this methodology can be helpful for gathering data, it might not be adequate to capture the complexity and nuances of the community's social norms and sanitation behavior. Qualitative approaches, including focus groups and interviews, could have given a deeper knowledge of the problems. Third, a sizable fraction of previously ODF-certified villages had returned to OD, according to the study's high reversion rate

of 66.1%. However, the study falls short in its examination of the causes of this high rate of reversion. It would have been beneficial to establish targeted interventions if it had been possible to pinpoint the precise causes of reversal. Fourth, the study shows relationships between various social norms, sanitation-hygiene behaviors, and ODF status. But we are unable to demonstrate causation because of the cross-sectional character of the study design. The investigation of causal linkages might be better served by longitudinal research or experimental approaches.

The study also depends on self-reported data from questionnaires, which could be biased by social desirability or recollection. Respondents could misrepresent their adherence to hygienic habits or give answers they think are socially acceptable. Additionally, the study does not assess how well different sanitation strategies stack up against CLTS treatments in obtaining ODF status. This comparison would have given a more thorough picture of the effectiveness of the intervention. Additionally, the study concentrated mostly on social norms and sanitation-hygiene behaviors. The status of ODFs and their potential for reversal may also be significantly influenced by other variables, including socioeconomic position, education, and resource availability. The study's breadth and potential policy consequences are constrained by omitting these factors. The study's results might also be unique to Suna West Sub County and difficult to extrapolate to other areas with distinct sociocultural and economic contexts.

The study offers a helpful starting point for comprehending ODF status reversion, the significance of sanitation-hygiene behaviors, and social norms in general. Future study, meanwhile, should focus on the above-mentioned limitations in order to reach solid conclusions and create successful solutions. In addition, integrating quantitative and qualitative approaches may provide a richer,

more nuanced knowledge of the problems associated with long-term behavior change in sanitation practices.

Ellis et al. (2020) undertook a study in western Kenya in order to better understand the links between fecal pathogen exposure, childhood diarrhea, stunting, and their negative short- and long-term impacts on children's health. The researchers wanted to know what characteristics affected how often families with young children (CU2) used latrines, disposed of their children's waste, and provided a clean and safe environment for them to play in. The final objective was to create an efficient behavior change intervention that would focus on nutrition and WASH practices to lessen stunting.

The research employed a mixed-methods approach, incorporating 24 semi-structured household observations that specifically examined feeding, hygiene, and sanitation practices. Additionally, 18 focus group discussions were conducted with caregivers of children under the age of two, and 29 key informant interviews were carried out with community leaders, health workers, and project staff. The caregiver behavior mapping was based on the theoretical framework known as the capability, opportunity, motivation, and behavior (COM-B) model.

The lack of latrines, the high cost of permanent building materials, and the social shame attached to unattended OD are only a few of the obstacles to latrine use that have been documented. The absence of latrines, the time-consuming nature of safe disposal techniques, misconceptions regarding the safety of infant feces, and caregivers not knowing where their infants had defecated also presented challenges to the proper disposal of child waste. In addition, it was difficult to keep shared human and animal compounds clean enough for children to play, and maintaining

appropriate play areas was problematic. The fact that caregivers believed the short-term costs of implementing these desirable behaviors to be higher than the possible long-term benefits was a notable result. In this particular setting, adopting the best WASH habits was significantly hampered by this mentality.

The study stressed the need of overcoming these identified barriers and utilizing facilitators to promote the adoption of ideal WASH habits based on these research findings. The researchers came to the conclusion that a successful intervention design should put an emphasis on overcoming these challenges and emphasizing the advantages of encouraging young children under the age of two to develop healthy habits in the areas of nutrition, hygiene, water, and sanitation. By doing this, the intervention may significantly improve the general health of children in the area while lowering childhood diarrhea and stunting.

The study had a number of limitations, despite the fact that it offers important insights into the factors influencing latrine usage, disposal of child waste, and the establishment of a clean and safe play environment for young children in families in western Kenya. First of all, with only 29 key informant interviews, 18 focus groups, and 24 household observations, the study's sample size appears to be somewhat tiny. The diversity of experiences and viewpoints within the population may not be adequately represented by this small sample, which could result in an insufficient knowledge of the factors impacting actions. Second, because the study concentrated on western Kenya, its findings could not be applicable to other areas with differing cultural, socioeconomic, and environmental conditions. To get a better grasp of the issue, it would be helpful to carry out similar studies in other fields. Additionally, since the study was done in 2016, conditions and

behaviors may have changed. A more recent study would give current information on the difficulties and chances for assistance.

Despite serving as the theoretical foundation for mapping caregiver behavioral determinants, the COM-B model may not fully account for the difficulties of behavior change, particularly in the setting of WASH and nutrition practices. It could be possible to gain a more thorough understanding by combining the COM-B model with various theoretical vantage points. Furthermore, the study makes extensive use of qualitative data, which can make it more difficult to quantify the connections between factors and come to more specific findings. The study would be more robust if quantitative and qualitative results were combined. Although the study identifies factors that can help or hinder behavior change, it doesn't offer any precise suggestions for creating successful interventions. The study would be more useful in practice if it offered specific, evidence-based recommendations for intervention tactics. Additionally, the study makes no mention of particular ethical issues, like getting participants' informed consent or addressing potential biases during data collection and processing. Any research involving human participants must adhere to ethical standards. Last but not least, the study lacks a follow-up to evaluate the long-term effects of any treatments based on these findings and instead largely focuses on identifying barriers and determinants of behaviors. It is essential to comprehend the intervention's effectiveness over time in order to evaluate its success.

Overall, the study offers a basis for comprehending the difficulties experienced by families with small children in western Kenya with regard to WASH and nutrition practices. The study would

be more credible and useful in helping to design successful strategies to lower childhood diarrhea and stunting, nevertheless, if the aforementioned flaws were addressed.

Baker et al. (2018) undertook a study to comprehend the diversity of enteric infections seen in young children in areas with high disease burden. Its goal was to describe the variety of pathogen contamination in open spaces among urban slums in Kisumu, Kenya. The association between pathogen detection patterns and the hygienic conditions for people and domestic animals in these places was another focus of the researchers' work. To do this, the researchers gathered soil and surface water samples from 166 public locations in three different Kisumu areas. They detected the presence of 19 distinct intestinal pathogens using enterococcal tests and quantitative reverse transcription polymerase chain reaction (qRT-PCR). The researchers next used regression analysis to examine the relationship between the presence, concentration, and variety of enteric pathogens and the reported sanitary markers of contamination (such as enterococci).

The findings showed that 17 different enteric pathogen kinds have been found in Kisumu's public spaces. Multiple types of enteric pathogens were present in 33% of soil samples and 65% of surface water samples, indicating the prevalence of these pathogens. Interestingly, domestic animal waste was linked to a higher diversity of pathogens than human OD, deteriorating latrines, flies, or poor disposal of human waste. At 40% of the areas they looked at, the researchers also saw that small children were playing often. Therefore, it was crucial to comprehend the sources of pollution in order to effectively reduce health concerns. Based on their findings, the study implies that controlling domestic animal waste may be essential in lowering enteric pathogen environmental contamination in places with a high incidence of disease, such as Kisumu. Public health initiatives

may successfully lower the risk of enteric pathogen transmission to young infants and other susceptible populations by addressing this component of sanitation.

The study offers insightful information about the variety of enteric pathogen contamination in public areas of urban informal communities but has limitations and potential areas for improvement. First, just three communities in Kisumu, Kenya, were chosen for the study. The results might not apply to other urban informal settlements or high disease burden environments in various regions. Future research should involve a wider variety of locales to improve the generalizability of the findings. Second, the 166 public sites that were sampled might not be enough to fully represent the complexity of enteric pathogen contamination across the entire study area. A greater sample size might offer more reliable and thorough results. Third, changes in pathogen contamination over time are not taken into account by the study's cross-sectional approach. A deeper understanding of seasonal variations and dynamic patterns of contamination may be possible with longitudinal data collecting.

Additionally, the study focused on examining the connection between domestic animal waste and disease contamination. While this is unquestionably significant, it ignores the possibility of connections with other human factors, such as handwashing habits, food handling, and human waste disposal, which may potentially have a large impact on the spread of pathogens. Additionally, while enterococcal tests and qRT-PCR are excellent tools for pathogen detection, they might not fully account for all enteric pathogens that might be present in the environment. Culture-based techniques, for example, could supplement the findings and improve the precision of pathogen detection. Spatial patterns of contamination were not investigated in the study, which

could have provided important information on isolated areas with high pathogen prevalence and probable sources of contamination. Additionally, the complicated socioeconomic dynamics that frequently characterize urban informal settlements might have an impact on sanitary conditions and disease transmission. It would have been beneficial for the study if these factors had been examined in greater detail. Last but not least, while the study was primarily concerned with the presence and variety of pathogens in the environment, it did not thoroughly investigate how young children might be exposed, such as through contact with contaminated surfaces or water drinking.

Although the study adds valuable knowledge on enteric pathogen contamination in urban informal settlements, there are a number of drawbacks that require attention in subsequent studies. A larger, more representative study that uses a longitudinal design and takes into account socioeconomic and human-related factors could offer a more thorough knowledge of the dynamics of enteric pathogen transmission in areas with high illness burden.

Simiyu et al. (2020) did a study that was primarily concerned with the sharing of sanitation facilities in low-income areas of sub-Saharan Africa, specifically in Kisumu city, Kenya. Although it is frequently practiced in certain places, shared sanitation is regarded as a subpar sanitation service and might not help the world achieve its cleanliness goals. However, these shared amenities are the sole choice for many people of low-income villages. To lower OD and the danger of disease, these shared facilities must be kept cleaner and better managed.

The researchers conducted 39 in-depth interviews and 11 focus groups to look into the challenges and prospects for enhancing the cleanliness of communal restrooms in Kisumu city. The majority of the participants in these dialogues were city inhabitants from a low-income neighborhood, both

tenants and landlords. To identify the issue, define the desired behavior, and identify the required modifications, the researchers used a thematic approach to examine the data. The survey discovered that the majority of the communal restrooms in the low-income neighborhood were pit latrines used by both renters and landlords. The participants identified two key issues that were causing these communal restrooms to be dirty. First, there were problems with behavior, like improper use of the public restrooms. Second, there were social issues, including an unwillingness to cooperate in facility cleanliness. The researchers did note possible areas for development, though. These included putting in place clear cleaning schedules, improving communication among facility users, and creating efficient dispute resolution procedures between landlords and tenants. These methods might be used as a starting point for developing intervention strategies to improve the hygiene of shared sanitation facilities.

The study emphasized the need of emphasizing social factors in order to enhance the cleanliness of communal restrooms in low-income settlements. These communal facilities may be administered more skillfully by taking a social perspective, giving millions of Kenyans who live in poverty access to better sanitation. The study's findings offer significant support for strategies that adhere to the Joint Monitoring Program's (JMP) recommendation for high-quality shared sanitation facilities made by the World Health Organization (WHO).

Simiyu et al.'s study did not include additional factors like the safe treatment of fecal sludge from the shared facilities and instead focused primarily on cleaning procedures that affect the continuous usage of shared facilities. Further research may be done on these aspects of management outside of confinement facilities. The study also includes findings from a low-income neighborhood in

Kenya's Kisumu city. Although these results might be applicable to other low-income neighborhoods, they might not necessarily apply to places where the social and cultural contexts are the same and the situations are different. The applicability of sanitation methods, land ownership and/or tenure, and the interactions between landlords and tenants are a few examples of these variances. However, the study's methodology can be used to design and implement behavior change strategies for better cleanliness in environments that are similar.

According to a study done by Orimbo et al. (2020), cholera is still a persistent public health concern in Kenya in spite of improved awareness campaigns. The researchers understood the importance of evaluating community knowledge, attitudes, and practices (KAP) for successful planning and application of preventative interventions. In order to do this, the study concentrated on assessing the cholera KAP in a community in Kenya's Isiolo County.

Focus group discussions (FGDs) and a questionnaire survey were both used in the study's mixed-methods approach, which used a cross-sectional design. The researchers employed a multistage sampling technique for the questionnaire survey, using houses as the secondary sampling unit. A respondent who was at least 18 years old was questioned in each household and given a standardized questionnaire. The knowledge score was then determined by deducting one point from each response that was accurate. High knowledge scores were defined as total scores equal to or higher than the median score. To investigate the variables connected to a high knowledge score, descriptive statistics and multivariate logistic regression were computed. In parallel, the FGDs were held with randomly chosen participants who were at least 18 years old and had lived

in Isiolo for at least a year. The FGDs were conducted by the researchers using an interview guide, and content analysis was utilized to find important new themes.

The study involved 428 participants, the majority of whom (372 participants, or 86.9%) were female, with a median age of 30 years (Q1 = 25, Q3 = 38). 425 out of 428 participants, or 99.3%, had heard of cholera, and 311 out of 425 (73.2%) were aware that the illness is contagious. In terms of preventive measures, 273 out of 428 respondents (63.8%) understood the significance of purifying drinking water, however only 216 out of 421 respondents (51.3%) actually did so. Only 209 (40.8%) of the 428 individuals engaged in good defecation practices. Overall, 227 out of 428 individuals (53.0%) scored highly on the cholera knowledge test. Multiple elements were found by the researchers to be individually linked to a high knowledge score. These included being optimistic (adjusted odds ratio [AOR] = 2.88, 95% confidence interval [C.I] = 1.34-6.20), purifying water for consumption (AOR = 2.21, 95% C.I = 1.47-3.33), being under 36 years old (AOR = 1.75, 95% C.I = 1.11-2.74), and having a formal education (AOR = 1.71, 95% C.I = 1.08-2.68). The FGDs showed that challenges to cholera prevention and control included limited latrine coverage, insufficient water treatment, and sociocultural views.

The study's findings were summarized by pointing out that, despite the community's generally high level of cholera knowledge, there were still large gaps in preventive measures. Along with general efforts to improve health education throughout the community, the researchers advised tailored health education initiatives that specifically targeted older and less educated people. Such approaches might improve cholera prevention and control strategies in the research area and might also be useful in other places with comparable problems.

There are a number of limitations on the study's applicability, despite the fact that it offers insightful information regarding the cholera knowledge, attitude, and practices in a particular community in Isiolo County, Kenya. First, a multistage sampling technique was used in the study, with houses serving as the secondary sampling unit. However, it's possible that the sample strategy didn't fully represent the total population. The study sample's excessive female representation (86.9%) could lead to gender bias and restrict the applicability of the findings to a larger population. Second, the study was restricted to just one village in Kenya's Isiolo County, which may not be indicative of other areas of the nation or of other nations with various socio-cultural contexts. The findings' potential to be applied to larger groups may be constrained by the research population's lack of diversity. Additionally, the study's use of standardized questionnaires may have reduced the depth of responses and failed to adequately capture the nuanced views and opinions of participants regarding cholera. Furthermore, social desirability bias may alter self-reported data, lowering the accuracy of responses.

Additionally, the cross-sectional study design offers a snapshot of cholera KAP at a particular moment. In order to evaluate the efficacy of health education interventions, a longitudinal study design may offer a more thorough understanding of changes in knowledge, attitudes, and practices across time. Even if the study used focus groups to supplement the quantitative data, content analysis of the qualitative data may not be able to fully capture the diversity of viewpoints and experiences of the participants. Richer and more complex insights might have been obtained by employing more exact qualitative data analysis techniques. Additionally, the study depended on participant self-reports, which could be biased by recall. Participants could have trouble remembering details of prior activities or experiences connected to cholera. The study concentrated

on KAP associated with cholera but did not investigate other relevant factors such as access to healthcare, sanitation facilities, the involvement of livestock, and water bodies in cholera transmission and outbreaks. The study finds correlations between specific variables and high knowledge scores but does not prove causation. It is crucial to take into account additional potential confounding factors that could be used to explain these correlations. Finally, while the study suggests focused health education for particular groups, it offers no concrete tactics or interventions for effectively putting these suggestions into practice.

In summary, the study adds important knowledge regarding cholera KAP in a particular community in Isiolo County, Kenya. To provide more reliable and useful results for public health interventions and policy creation, future research should address the constraints in sampling, data gathering techniques, analysis, and generalizability.

Jepkorir and Nyaora (2007) sought to determine the association between OD and fecal-oral diseases in Burat and Ngaremara Wards in Isiolo County. The act of OD, which involves urinating outdoors without using suitable facilities, puts the environment and human health at serious danger. The researchers proposed that despite the existence of better options for the safe disposal of human excreta, people might still engage in this activity because of deeply ingrained behaviors.

The researchers used a cross-sectional study, which enables the gathering of information from a given population at a particular period, to accomplish their goals. Simple random sampling was employed as the sampling method to ensure that every family within the two wards had an equal chance of being chosen. 385 households in all were involved in the study. Observation checklists

and questionnaires were used to collect data for the study. With the help of these tools, the researchers were able to learn more about the respondents' fecal matter disposal practices.

The study's findings showed that 66% of respondents properly disposed of their waste, while 34% continued to engage in risky behaviors including OD. These results illustrate the persistent difficulties in getting rid of the practice of OD in the research area. The study provided prevalence proportions of fecal-oral infections in children under the age of 5 and in children above the age of 5 in terms of health consequences. In particular, among children under the age of 5, the prevalence of diarrhea was 142 per 1000, showing a comparatively high occurrence of this illness. Additionally, there were 21 per 1000 people in the same age range who had intestinal worms. Typhoid and diarrhea each occurred 20 times per 1000 children over the age of five.

According to the study's conclusions, OD still poses serious health concerns in the study area. In particular, it implies that supporting good disposal methods is crucial for lowering fecal-oral illnesses, like diarrhea and typhoid, among the local population. The deeply ingrained habits and behaviors that contribute to the persistence of this hazardous practice should be taken into account in efforts to reduce OD and introduce basic sanitation procedures. The findings might be used as the foundation for focused interventions and policy changes to enhance sanitation practices, which would ultimately improve the community's health in Burat and Ngaremara Wards in Isiolo County.

Although the study sheds light on the connection between OD and fecal-oral illnesses in the Burat and Ngaremara Wards, it had a number of flaws that limited its applicability. First, given the population of the study area, the sample size of 385 homes can be deemed to be somewhat small. The study's statistical power and the capacity to generalize its findings to the full population would

both be enhanced by a bigger sample size. Additionally, as simple random sampling does not ensure representation from all subgroups within the population, it may have produced a skewed sample. Cross-sectional studies have limitations when attempting to demonstrate causation or determine the temporal order of occurrences, despite being effective for gathering data at a particular moment. A longitudinal design would have allowed for a more thorough understanding of the cause-and-effect relationship over time between OD and fecal-oral infections, making the study more reliable. Additionally, using only surveys and observation checklists to gather data may result in response bias and social desirability bias. Instead than describing their actual habits, participants may give researchers the responses they believe they want to hear. A more complete picture of the participants' behaviors and motivations might have been obtained by combining qualitative and quantitative techniques, such as focus groups and interviews. Additionally, the study did not take into consideration any potential confounding factors, such as socioeconomic status, access to clean water, and hygiene practices, that might affect the association between OD and fecal-oral illnesses. The ability of the study to distinguish the effects of OD on health outcomes would be strengthened by controlling for these factors.

Additionally, the study's reliance on reported cases of typhoid, diarrhea, and intestinal worms could misrepresent the true prevalence of fecal-oral infections in the study area. The study might benefit from laboratory testing to validate diagnoses because self-reported health data could be vulnerable to recollection bias. The study's discussion and result interpretation are also somewhat constrained. The findings would be more practically applicable if they were subjected to further study and discussion of the reasons influencing the persistence of OD, as well as potential treatments and policy implications. The study was carried out in a particular geographic area, thus

it might not be relevant in other places with various cultural, socioeconomic, and environmental factors. The authors need to have been aware of the restrictions on extrapolating their results from the research area. The study also lacked a reference group of homes without an OD policy. A greater knowledge of the connections between OD and fecal-oral diseases would have resulted from such a comparison. Future studies that address these issues will improve the study's conclusions and advance knowledge of the effects of OD on human health in related situations.

The study by Mbae et al. (2020) examined the prevalence of typhoid fever and invasive non-typhoidal salmonellosis in Kenya, especially in areas with limited resources like the Mukuru informal community outside of Nairobi. Understanding the incidence, severity, and risk factors of these diseases in the area was significantly hampered by the lack of adequate access to clean water and sanitary facilities. The goal of the study was to identify the disease burden, geographic distribution, and pertinent socioeconomic and environmental risk factors linked to these infections between 2013 and 2017. In order to perform the study, a house-to-house baseline census encompassing the 150,000 residents of the Mukuru informal community was conducted. The residents' pertinent data on socioeconomic status, demographics, and healthcare utilization were gathered using structured questionnaires. The study's primary population included children under the age of 16 who visited three outpatient facilities with cases of fever or fever and diarrhea. Salmonella germs were cultivated from the children's blood and excrement. The researchers used the Pearson Chi-Square ($\chi 2$) test to see whether there is a relationship between particular Salmonella serotypes and risk variables.

16,236 children were included in the study. 1.3% of people had bloodstream infections brought on by Salmonella Typhimurium/Enteriditis, a type of Non-Typhoidal Salmonella (NTS). Salmonella Typhi was more common, with a 1.4% frequency, and it was most prevalent in children under the age of 16. The incidence of Salmonella Typhimurium/Enteriditis did not appear to be significantly correlated with the rearing of domestic animals, with the exception of chickens. However, it was discovered that raising hens was substantially linked to a greater incidence of S. Typhi (2.1%; p = 0.011). The study also discovered that, when compared to people who drank water straight from the faucet, utilizing water pots as storage containers was substantially connected with a greater percentage of kids who had Salmonella Typhimurium/Enteriditis (0.6%). Additionally, significant risk factors for S. Typhi infection were found to include OD and usage of pit latrines (1.6%; p = 0.048). Additionally, compared to those who did so on average 1 to 2 times per week, the percentage of kids who had Salmonella Typhimurium/Enteriditis was higher among those who ingested street food four or more times per week (1.1%; p = 0.032).

The study's main finding was that typhoidal and NTS infections play a significant role in disease, particularly in children under the age of 16 living in the Mukuru informal community. The researchers advised improving WASH practices, such as boiling water, encouraging breastfeeding, encouraging proper handwashing, and avoiding animal contact in domestic settings, to lower the risk of transmission of Salmonella diseases from contaminated environments. These actions may be essential in reducing the number of illnesses in the research area.

There are some limitations that affect the study's application, despite the fact that it offers insightful information about the prevalence and risk factors of typhoid fever and non-typhoidal salmonellosis

in the Mukuru informal settlement. First, when evaluating disorders having substantial public health implications, the study's sample size of 16,236 youngsters may be viewed as being relatively small. More accurate and representative data for the population in the informal settlement might have been obtained from a bigger sample size. Second, the study excluded cases of minor infections or kids who did not seek medical attention since it only included kids who sought treatment at outpatient clinics. This strategy might have caused selection bias and overestimated the true burden of disease in the neighborhood. Third, not all pertinent variables may be captured when socioeconomic and demographic data are gathered through structured questionnaires. It's possible that certain important elements impacting disease risk, such personal cleanliness habits and food sources, have not been sufficiently investigated.

Additionally, the serotyping method used in the study to identify Salmonella strains might not accurately reflect the variety of serotypes that exist in the general population. The community's circulating Salmonella strains could have been better understood using molecular techniques like whole-genome sequencing. Additionally, the study's four-year time frame ran from 2013 to 2017. The prevalence of diseases and their risk factors throughout time may have changed or trended over time, according to longitudinal data. The study also examined relationships between Salmonella infections and risk factors, although it might not have taken into account potential confounding factors like access to healthcare or exposure to other pathogens that could affect these relationships. Additionally, because various regions have diverse socioeconomic, environmental, and cultural circumstances, the findings could not be immediately applicable to them. The study's inability to be applied to other regions is due to its concentration on a single informal settlement in Nairobi. Although the study found correlations between some risk variables and Salmonella

illnesses, it did not prove causation. The observed relationships may be influenced by additional, unmeasured factors. Lastly, although the study recommended enhancing WASH practices, it did not assess the efficiency of certain interventions or offer comprehensive instructions on how to put such measures into action.

Despite these criticisms, the study does offer valuable preliminary information about the epidemiology and risk factors of typhoid fever and non-typhoidal salmonellosis in the Mukuru informal community. To improve our knowledge of the diseases and inform focused therapies, future research should address these shortcomings.

The goal of Musuva et al.'s (2021) study was to determine why, after numerous rounds of mass drug administration (MDA) campaigns, Schistosoma mansoni prevalence is still high in some areas in western Kenya while it has decreased in others. The study argued that there are other factors besides OD that increase the region's susceptibility to disease. The terms "responding villages" (R) and "persistent hotspot villages" (PHS), respectively, were used to describe the two different types of villages.

To find out what causes the Schistosoma mansoni prevalence in the PHS villages to remain so high, the researchers utilized a cross-sectional quantitative technique. Using portable smartphones and the Commcare platform, they mapped water interaction sites, which were locations where individuals regularly interacted with water (e.g., gathering water, washing clothes, bathing, swimming, playing). In order to evaluate OD practices as well as water usage and contact patterns, they also carried out quantitative surveys using semi-structured questionnaires. The surveys were conducted among 50 students, one head teacher, and 15 households each hamlet. In addition, 50

adults from both R and PHS villages and 50 schoolchildren between the ages of 9 and 12 were each given one stool sample and one urine sample. The Kato-Katz method was used to examine stool samples in order to look for soil-transmitted helminths and S. mansoni eggs. To find S. mansoni antigen, urine samples were examined using the point-of-care circulating cathodic antigen (POC-CCA) test.

According to the study's findings, the PHS villages had less latrine coverage than the R villages. The WHO standard for the boy:latrine coverage ratio was only satisfied by 33 percent of schools in PHS villages compared to 83.3% of schools in R villages. The ratio of girls to latrines was not satisfied in any of the communities. Additionally, a greater percentage of people in PHS communities used unprotected water sources for drinking and bathing, with 68.5% of children and 89% of adults doing so. In PHS communities, access to water sources was also more common, particularly for swimming. According to the selection criteria, it was hypothesized that the prevalence and severity of S. mansoni would be higher in the PHS villages than the R villages. S. mansoni was more common in PHS villages (43.7%) than R villages (20.2%). PHS villages (73.8 200.6) had a higher infection intensity (number of parasite eggs per unit of feces) than R villages (22.2 96.0).

In summary, the study determined that low toilet coverage and unprotected water sources were major contributors to the persistently high prevalence of schistosomiasis in the PHS villages in western Kenya. To strengthen control efforts and lower the prevalence of schistosomiasis, the researchers advised actions to boost the availability of potable water and upgrade latrine infrastructure in these communities.

There are a number of limitations that have an impact on the study's conclusions, despite the fact that it offers insightful information on the causes of the high prevalence of Schistosoma mansoni that persists in some villages after repeated mass drug administration (MDA) campaigns. The study concentrated on particular settlements in western Kenya, which might not accurately reflect the variety of factors impacting the prevalence of schistosomiasis in other areas or nations. As a result, the findings might not be very generalizable. Second, the study used a cross-sectional design, which offers an instantaneous view of the issue. Establishing causality or establishing temporal correlations between variables and schistosomiasis prevalence using this design is not appropriate. Additionally, only a tiny proportion of homes, students, and adults in each hamlet were surveyed for the study. A bigger sample size would have improved the findings' reliability and statistical power. Based on measured prevalence levels, the villages were also divided into "responding villages" and "persistent hotspot villages." The grouping criteria were not explicitly stated; hence this categorization could have selection bias.

Additionally, the lack of a control group in the study prevented comparisons of the intervention's impact on schistosomiasis prevalence in treated and untreated areas. Additionally, because the study relied on self-reported data from interviewer-based surveys, recall bias and social desirability bias may have been introduced. Additionally, due to variations in egg excretion over time, the use of a single urine and stool sample per participant may not accurately reflect each person's infection status. Although the study concentrated on water consumption and contact patterns, it did not fully examine other possible behavioral aspects that can affect the transmission of schistosomiasis, such as sanitation procedures, hygiene habits, and water treatment. There was also no investigation into additional potential variables. The study focused on unprotected water sources and a lack of

latrines, but it did not look at other potential causes of schistosomiasis persistence, such as environmental factors, climatic circumstances, or the influence of regional cultural traditions. The study's design appears to be purely quantitative, but a multidisciplinary strategy that takes into account social, economic, and environmental issues could lead to a more thorough knowledge of schistosomiasis persistence. Lastly, the efficiency of the MDA programs themselves was not taken into account. This may have contributed to the discrepancies between responding and persisting hotspot communities.

In conclusion, the study offers important preliminary information on the factors determining the persistence of schistosomiasis, although the breadth and depth of its conclusions may be constrained by the study's limitations in terms of design and lack of a thorough methodology. Future research should address these issues and use a more thorough and varied approach to better understand the variables influencing schistosomiasis prevalence and prevention strategies.

The study by Legge et al. (2021) sought to address the issue of the low sustainability of many sanitation programs and the possible consequences to communities when toilet facilities are not properly maintained or replaced, resulting in exposure to environmental infections. The study's main goal was to comprehend the variables that influence maintained access to sanitary facilities after a project's completion. The study looked at changes in sanitation access between 2015 and 2017 in Kwale County, Kenya, using data from a cohort of 1666 households. Sanitation access was defined for the study as having useable, operational access to a toilet facility, whether improved or unimproved, inside the confines of the household complex. To determine their correlations with (1) the odds of maintaining sanitation access and (2) the odds of getting sanitation

access, the researchers took into account a number of environmental, psychological, and technological factors, including confounders.

The survey discovered that over the two-year period under consideration, 28.3% of families were able to maintain access to proper sanitation facilities, 4.7% lost access, 17.7% acquired access, and 49.2% remained without access. The results of the study showed a number of important criteria that were linked to a higher likelihood that households would continue to have access to sanitation. The likelihood of continuing to have access to sanitation facilities was greatly influenced by not sharing the facility and having a sturdy washable slab. On the other hand, the study also found elements linked to higher chances for households to have access to sanitation. These included having a household head who had completed at least their secondary education, having coarser soil fragments (which can affect the viability of building facilities), and having higher local sanitation coverage (which suggests the influence of community-level sanitation programs). Overall, the study's findings offer insightful information that sanitation programs can use to increase the rates of initial and ongoing use of sanitation facilities. Sanitation interventions can be created more efficiently and contribute to better public health and environmental outcomes for the communities they serve, not only in Kwale County, Kenya, but possibly in other settings that are similar as well, by understanding the factors that drive sustained access.

The Legge et al. (2021) study has a number of drawbacks. 1666 homes in a particular area of Kenya (Kwale County) make up the study sample. Although the findings are pertinent to this specific situation, there may not be much generalizability to other areas or nations. If the sample had been larger, more representative, and more diverse, the study would have been more robust.

Additionally, the study examined data from 2015 to 2017, therefore the conclusions are based on patterns and circumstances that existed during that particular time period. Since then, sanitation availability and practices may have changed, making the study's findings inaccurately reflect the state of affairs now. Although the study took into account a number of contextual, psychological, and technological confounders, it may have missed certain significant elements that could have an impact on the sustainability of sanitation access. For instance, community involvement, cultural norms, and economic variables may have had an impact on sanitation practices. The study also characterized access to a functioning, in-use facility within the household compound as either an upgraded or unimproved facility. This definition, however, might fall short of capturing the entire scope of sanitation requirements and quality since it places too much emphasis on facility existence and functionality at the expense of things like waste disposal and hygiene standards.

The study appeared to have a cross-sectional design because it examined data from two periods in time without taking into consideration any alterations or advancements that occurred during that time. Understanding the dynamics of sanitation access through time would have been better accomplished with a longitudinal study design, which follows families over an extended period. Although the study evaluated associations using logistic regression models, confounding factors may have been present that were not sufficiently controlled for in the analysis. The reported associations' validity may be impacted by these unaccounted-for circumstances. The study's data's precision and dependability may also be called into doubt. The findings may be inaccurate because self-reported data, which may have been used, is susceptible to recall bias or social desirability bias. The study mainly used quantitative data, and the communities involved provided no qualitative insights. A deeper knowledge of the cultural, social, and economic factors affecting

sanitation access decisions may have been achieved through the use of qualitative data. Finally, while the report makes the case that sanitation programs can use the findings to increase adoption rates, it offers no concrete policy suggestions or doable solutions for achieving this objective.

Overall, the study adds to our understanding of sanitation access sustainability, although there are several areas that should have been covered more thoroughly to increase the effect and generalizability of the study. Some of the above-mentioned shortcomings may be addressed by future research with a wider focus, improved study design, and a mix of quantitative and qualitative methodologies.

Kithuki et al.'s (2021) study objected to evaluate WASH coverage and practices in two subcounties of Kitui County, a semi-arid area of Kenya. The semi-arid areas of Kenya, particularly Kitui County, still confront substantial environmental difficulties despite modest advancements in sanitation and hygiene. Utilizing a variety of data gathering techniques, the researchers carried out a cross-sectional survey. From 757 houses in the research region, the household heads were questioned. Descriptive statistics were used to examine the survey's quantitative data. Five focused group discussions and key informant interviews were also conducted, and the resulting qualitative data were then thematically analyzed.

According to the survey, 39.9% of residents in the area get their water from rivers. To access water sources, a sizeable majority of the population (57.4%) had to walk more than two kilometers. Additionally, only 11.9% of the water sources were accessible for the entire year, indicating an insufficient and inconsistent supply of water. 47.4% of the population used the average daily water use of 13.3 liters, according to the data. Water was, however, expensive, costing an average of

Ksh. 35 per 20-liter jerry can. 43.6 percent of the population said their water collection efforts were insufficient to meet their daily needs. The majority of respondents preferred filtering as a method of water purification and believed that clean water was safe to consume. This might not always be the best technique to guarantee the safety of the water, though. Only 56.4% of families had access to latrines, according to the research, and 8.5% relied on OD. This shows a serious dearth of proper sanitary facilities, which contributes to unhygienic conditions.

Overall, the study brought attention to the poor sanitation, lack of hygiene coverage, and insufficient and filthy water supply in the semi-arid areas of Kitui County, Kenya. The results point to the necessity for scaling up WASH activities to achieve the suggested national requirements and enhance the community's living and health conditions in these areas. To address these issues, politicians, local authorities, and numerous stakeholders must work together to ensure that the population has access to a safe and sufficient quantity of water, good sanitation, and hygiene education.

Despite offering important information about the WASH conditions in Kitui County's semi-arid districts, Kithuki et al.'s study had a number of limitations. First, it is possible that the study's sample size of 757 homes is not typical of the overall population in the semi-arid parts of Kitui County. The selection of subcounties and households may have generated selection bias, which may have impacted how broadly the results could be applied to the entire region. Second, the study's cross-sectional design enables the collecting of data at a particular time. The ability of this architecture, however, to demonstrate causal linkages or record changes over time is constrained. A more thorough comprehension of the WASH conditions and how they change could be obtained

through longitudinal studies or quasi-experimental approaches. Thirdly, the study used mixed methods, fusing quantitative information from household interviews with qualitative information from focus groups and key informant interviews. Although this method can offer thorough insights, it may also cause problems with data integration and make it unclear how much weight should be given to quantitative and qualitative data.

Furthermore, the use of household heads' self-reported data raises the possibility of response bias and social desirability bias. People may overestimate the adoption of particular activities, such water purification techniques and toilet use, or they may give socially acceptable answers. The study does not compare Kitui County's semi-arid regions to those of other regions or the nation as a whole, instead concentrating on the conditions there. The context and understanding of how these regions compare to others in terms of WASH indicators would be provided through a comparative analysis. Although the report acknowledges the inadequate WASH conditions, it makes no recommendations for policy changes or feasible intervention measures to effectively address the issues. The effect and usefulness of the study could be increased by doing a more thorough analysis of the potential solutions. The study mentions the use of theme analysis for qualitative data as well as descriptive statistics for the examination of quantitative data. However, there is a lack of detailed explanation of the precise methodologies and analytical approaches applied. The study would be more rigorous if the data analysis process was explained in more detail.

While the study offers important details on WASH conditions in Kitui County's semi-arid areas, there are limitations in the study's design, data collection procedures, and data processing that should be taken into account when interpreting and extrapolating its findings. To build on this

study and inform more successful actions to enhance WASH conditions in the area, future research should address these shortcomings.

The study by Osiemo et al. (2019) concentrated on the basic right to obtain potable water for dignity and wellbeing. More than 1.1 billion people, mostly in Sub-Saharan Africa and Southeast Asia, were reported to lack access to clean drinking water. The primary goal of the study was to evaluate the microbiological quality of drinking water and the prevalence of diseases associated with water in Kenya's Marigat town, which is located in the county of Baringo. The scientists took water samples from a variety of places, including boreholes, rivers, wells, and residences where it was being used. Using the most likely number method, they examined the samples for the presence of Escherichia coli and total coliform (TC) germs. Additionally, they used a portable meter from Wagtech International to take in-depth readings of pH and temperature. The researchers examined clinical health records from nearby health institutions to determine the prevalence rates of disorders associated with water.

The study discovered considerable variations in the concentrations of Escherichia coli (E. coli) and total coliform (TC) bacteria among water sources during both the dry and rainy seasons. Drinking water from big plastic storage containers, or "sky-plast," had the highest levels of E. coli and TC. Furthermore, for TC and E. coli concentrations, there were notable relationships between water sources and seasons. Typhoid (10%) was the most common water-related illness during the dry season, while diarrhea (3%) predominated during the wet. The investigation came to the conclusion that all drinking water in Marigat was microbiologically contaminated, offering significant health concerns to consumers both at the site of abstraction and at the point of

consumption. In order to decrease the prevalence of diseases associated with drinking water, the researchers advised the creation of public health awareness initiatives on household water management. They also stressed the necessity for local and national public health professionals to guarantee that households have enough access to potable water and proper sanitation. The researchers sought to enhance the general health and well-being of people living in the study area by addressing these problems.

Despite providing important data on the microbiological quality of drinking water and the frequency of diseases associated to water in Marigat, Baringo County, Kenya, the study had a number of shortcomings. First off, the report makes no indication of the precise sample size that was taken from each residence and water source. Results would be more solid and dependable if they were drawn from a bigger, more representative sample. Second, the study's exclusive emphasis on Marigat Town in Baringo County limits the applicability of its conclusions to other parts of Kenya or other nations that have comparable water-related problems. Third, the study does not offer a long-term evaluation of water quality and illness prevalence throughout the year, appearing to have only collected data during specific seasons (dry and rainy). The identification of trends and changes in water quality over time may be aided by longitudinal data. Additionally, the study only looked at total coliform bacteria and Escherichia coli, which are crucial signs of water contamination. It could have been more thorough if it had included more microbiological markers (like fecal coliforms) and other water quality measures, such as chemical contaminants (like heavy metals).

Furthermore, the study's dependence on examining clinical health data from neighborhood health clinics would understate the true prevalence of disorders associated with exposure to water. Underreporting may occur because some people may not seek medical assistance for minor aquatic diseases. The analysis skips over the root reasons of the water pollution in Marigat, which would have been helpful in recommending focused actions and remedies. The paper also acknowledges the issue of tainted drinking water but does not suggest any concrete controls or suggestions for source protection or water treatment. It is noteworthy that the study makes no mention of any potential conflicts of interest or biases that might have affected the way the research was conducted or how the findings were interpreted. The study also makes no mention of any ethical permissions sought for the research's conduct, such as Institutional Review Board (IRB) approval or participant informed consent. Last but not least, the study did not assess the success of any current public health awareness initiatives or campaigns pertaining to water management and sanitation.

To improve its scientific rigor and practical relevance, the study might benefit from resolving the aforementioned constraints, even though it provides insightful information about the water quality and disease prevalence in Marigat. In order to enhance access to clean drinking water and public health in the area, a more thorough and multifaceted study could offer a more nuanced knowledge of the water-related difficulties and assist in the design of more successful interventions.

Kasiva et al.'s (2022) study examined the influence of cultural factors on the adoption of sanitation practices in rural regions in recognition of the possibility that the supply of sanitation infrastructure alone might not be sufficient to achieve sustainable sanitation solutions. To obtain comprehensive insights, the researchers employed a convergent study strategy, incorporating both qualitative and

quantitative data collection techniques. 100 household heads were given standardized questionnaires in order to collect quantitative data. Stratified and proportionate simple random sampling procedures were used to choose the households. Additionally, interviews with a focus group of nine carefully chosen volunteers were used to gather qualitative data. The results were narratively presented and arranged into topics. To evaluate the quantitative data, the researchers used STATA. The correlations between the variables were found using descriptive and inferential statistics.

The study found that, with a mean coverage of 3.3094, using unimproved toilets was the most common sanitation method in the area. Sanitation practices were significantly influenced by gender roles because they were more likely to be adopted when gender norms were upheld (p-value = 0.000). On the other side, following particular traditions was linked to a decline in the adoption of sanitation practices (p-value=0.014). Interestingly, some religious doctrines and customs altered people's attitudes toward cleanliness. For instance, certain religious groups believed that diarrhea was caused by demons rather than bad hygiene, which encouraged bad hygiene habits. The practice of using OD sites for witchcraft rituals, however, helped to eradicate OD. The study also discovered that several gender duties, such carrying water, gathering firewood, and caring for livestock in rural places, encouraged OD. These habits were probably caused by the absence of sanitary amenities in those areas.

The researchers offered some suggestions to support better sanitation practices in rural regions in light of their findings. They recommended including women in decision-making about household sanitation, realizing their capacity to influence beneficial changes. Religious authorities might also

be enlisted as sanitization behavior change advocates. Finally, the study stressed the necessity for future research to take into account a variety of elements, including cultural aspects along with environmental, demographic, and economic considerations when looking at the adoption of sanitation methods. Rural populations may benefit from sanitation measures that are more efficient and long-lasting if the interactions between these many components are well understood.

Although the study offers insightful information about how cultural influences affect rural sanitation practices, there are various areas where limitations restrict conclusions. First, with only 100 household heads and nine participants in the focus group, the study's sample size is quite tiny. The generalizability and statistical power of the study might have been improved with a bigger sample size. Although proportionate simple random selection and stratified sampling were employed in the study to choose the houses, it is unknown how representative the sample is of the total rural population. The validity of the study may have been impacted by biases introduced by the sampling techniques. Additionally, because only one focus group was used in the study, there was less variance in the qualitative data. A more thorough knowledge of the cultural influences on sanitation practices would have been possible with the inclusion of additional focus groups or individual interviews from various communities.

In addition, the study used a convergent research strategy that included qualitative and quantitative data. Cross-validation and triangulation of results, which could increase the study's trustworthiness, were not mentioned. Additionally, STATA was mostly used in the study's quantitative data analysis, with an emphasis on descriptive and inferential statistics. Although STATA is a useful tool, the study's analysis may have been strengthened by using other statistical

techniques or data visualization strategies. The study shows relationships between cultural elements and hygienic habits but does not prove causation. Cross-sectional data cannot be used to infer causal relationships, and doing so could result in misunderstandings. Notably, the study makes no mention of moral issues like participant risks, confidentiality, or informed permission. The need for ethical considerations in research involving human participants should have been made clearer. Additionally, the study ignored other relevant elements like economic, educational, or infrastructure features that may have an impact on sanitation behavior in favor of focusing primarily on the cultural influences on sanitation behaviors. Additionally, several interpretations of the data seem speculative and require thorough investigation. The study's credibility might have been enhanced by a more in-depth investigation and contextualization of the findings. In conclusion, the study offers important insights into the cultural elements impacting sanitation practices in rural areas, but it also has limitations that should be acknowledged, including sample size, data collection techniques, and analytical procedures. In order to get a more complete understanding of sanitation behavior in rural populations, future research should address these constraints.

Antwi-Agyei et al. (2022) look into the elements that affect shared home toilet quality in low-income metropolitan areas of Ghana and Kenya. The goal of the study was to find out if any public restrooms can provide the same quality of service as private restrooms despite common reservations regarding shared restroom cleanliness and accessibility. The study used a mixed-method approach that included field inspections and household surveys. 843 respondents in total were surveyed, and 838 home shared restrooms were examined. The findings of facility inspections were used to determine cleanliness scores, and 13 factors related to hygiene, privacy,

and accessibility were used to determine an overall quality score. To find determinants of cleanliness and overall quality of the shared sanitation facilities, regression analyses were performed.

The results showed that although just about a third (32%) of the shared toilets (out of 434) were found to be clean in Kenya, more than four out of five (84%) of the shared toilets (out of 404) were determined to be clean in Ghana. The likelihood of cleanliness was considerably raised by the presence of flush/pour-flush toilets (p 0.01; aOR = 5.64). Additionally, there was a threefold (p 0.01 aOR = 2.71) and a twofold (p 0.01 aOR = 1.92) rise in the likelihood of shared sanitation cleanliness when a toilet facility had a working outside door lock and when the landlord lived on-site. Additionally, the survey found that restrooms used by no more than five homes were typically cleaner. The survey also found that high-quality communal restrooms frequently had on-site landlords, working door locks, and were water-dependent. Given the increasing reliance on such facilities, the authors stressed the significance of investigating creative methods for maintaining the quality of these high-quality shared toilets in order to consider them appropriate for classification as basic sanitation.

The study advances knowledge of communal restrooms in low-income metropolitan regions of Ghana and Kenya and emphasizes the elements that can enhance the cleanliness and standard of these common restrooms. The results might significantly affect sanitation planning and interventions in comparable situations that seek to improve access to fundamental sanitation services for underprivileged groups.

The study has various limitations that affect its conclusions even though it offers insightful information about the standard of shared home toilets in low-income urban neighborhoods in Ghana and Kenya. The study's sample size, which includes 843 participants and 838 shared restrooms, is somewhat modest. This small sample size might not accurately reflect the various situations and variances in shared restrooms across the two countries. Furthermore, the study's emphasis on urban low-income areas could result in selection bias because the results might not extend to other contexts or socioeconomic groups. Additionally, the study assesses the standard of communal bathrooms but does not contrast them with private toilets. A more thorough analysis of the problem would involve knowing how clean and high-quality the public restrooms are in comparison to the private ones. Additionally, only 13 characteristics pertaining to accessibility, privacy, and hygiene were used to determine the study's quality score. Although these metrics are important, they might not account for all factors that affect the standard of shared restrooms. The analysis would have been more thorough had it included additional indications, such as upkeep, the presence of handwashing stations, and waste disposal. Additionally, due to the cross-sectional form of the study, it is not possible to examine how the standard of shared restrooms has changed over time. An understanding of the sustainability and longevity of the elements affecting cleanliness and quality would have been possible with the use of longitudinal data.

When transferring the findings from Antwi-Agyei et al.'s study to other contexts or higher-income regions, care should be used because it concentrates on two distinct nations and low-income urban groups. Depending on the geography and socioeconomic setting, many elements might have a considerable impact on the quality of communal restrooms. Additionally, the study uses fieldwork and household surveys to obtain data. The accuracy and dependability of the results may be

compromised by reporting bias and observer bias, despite the fact that these techniques are frequently used in this type of research. Regression analysis is used in the study to find factors that are predictive of overall quality and cleanliness. The study's observational design, however, might make it more difficult to prove causation. The observed relationships can also be influenced by confounding factors that were not taken into account during the research. Finally, the study briefly touches on the variables linked to better levels of cleanliness and quality but does not explore further the possible ramifications of these findings or offer suggestions for changes in practice or policy. Due to the study's sample size, breadth, and generalizability constraints, it is important to interpret the results with caution even though they provide light on the cleanliness and condition of shared home toilets in certain low-income urban populations. To provide a more thorough grasp of the subject, future research in this field should take into account larger and more diverse samples, longitudinal designs, and a wider range of indicators.

Kendi (2022) examined the topic of inadequate sanitation facilities and how it affects OD in Kenya's Tigania West Sub-County It was said that over 5 million people in Kenya are compelled to urinate in the open, contributing to the high prevalence of WASH-related disorders including diarrhea. It was also noted that 2.5 billion people worldwide lack access to proper sanitation facilities. The study's major goal was to evaluate household sanitation practices in Tigania West in relation to containment and disposal systems and to acquire information to encourage the safe disposal of human waste. The researchers employed a mixed study design to do this, gathering information from questionnaires, interview guides, and observations. They chose respondents using a cluster sampling technique, and STATA was used to analyze the results.

According to the findings, 95.2% of respondents had access to a bathroom, while 4.8% did not. In families with toilets, 72% built their latrines out of wood and iron sheet, while 54.3% had pit latrines without a slab. The study also revealed that most homes had unclean toilets, with 66% of them having excrement on the floor, endangering the health of those who used them. Furthermore, 53.2% of the households chose to construct new latrines rather than emptying them when they were full. Additionally, privacy was a problem because latrines in 20% of the households did not provide any seclusion, which discouraged their usage. Additionally, 6.4% of homes disposed of children's waste in the environment, compared to 71.8% of households who did it in the latrine. Additionally, more than half of the residents (53.2%) lacked toilet cleaning supplies and disinfectants. In addition, 37.7% of the respondents never used soap and water to wash their hands after using the restroom or defecating in the open. The study also found strong positive relationships between sanitation practices and cultural norms, toilet sharing, living space constraints, and financial difficulties. This shows that factors such as limited access to public restrooms, a lack of available space, and financial restraints influence sanitation habits in the area.

In order to enhance sanitation among households in Tigania West Sub-County, the article concludes by emphasizing the necessity for creative approaches to toilet construction using locally accessible materials, training, subsidies, and behavioral change sensitization. By addressing these problems, the study hopes to enhance sanitation procedures and lessen OD, which would ultimately benefit the region's public health.

Although the paper offers insightful information about the sanitation practices and difficulties that households in Tigania West Sub-County, Kenya, encounter, there are a number of areas that might

be improved or addressed to raise the level and depth of the research. First off, the report makes no mention of the overall population of the Tigania West Sub-County or the methodology used to establish the sample size of 236 respondents. Without these data, it is difficult to judge the sample's representativeness and the applicability of the results to the full population. Second, the paper does not compare its issues with sanitation to those in other areas or nations. Such comparisons would have given readers a wider context in which to comprehend the seriousness of the problem and potential solutions. Third, although the article acknowledges the use of questionnaires, interview guides, and observations for data collection, it provides no information regarding the design, validity, or reliability of these instruments. The credibility of the study would be improved by a more thorough presentation of the research process.

Despite mentioning SPSS for data analysis, the report makes no indication of the precise statistical tests that were employed to reach its conclusions. More information on the statistical techniques used might enhance the research findings. Additionally, the paper only quickly discusses the findings without going into great detail on their implications and real-world uses. The study would be more useful if it provided additional information on prospective interventions as well as solutions to the problems that have been discovered. Although the text emphasizes the link between cultural practices and sanitary behavior, it does not go into greater detail on the precise cultural ideas and practices that do so. The study would gain depth if these social and cultural elements were examined in greater detail. Furthermore, while lacking a long-term perspective, the piece offers a picture of the existing sanitation procedures. A longitudinal research could be used to monitor evolution of sanitation practices and evaluate the efficiency of interventions. Finally,

the study did not address ethical issues that are crucial when using human subjects in research, such as informed consent and data privacy.

Overall, there is need for improvement in the research methodology, data analysis, discussion of findings, and practical recommendations despite the article's focus on the sanitation issues that households in Tigania West Sub-County face. The legitimacy and significance of the study would increase if these shortcomings were addressed.

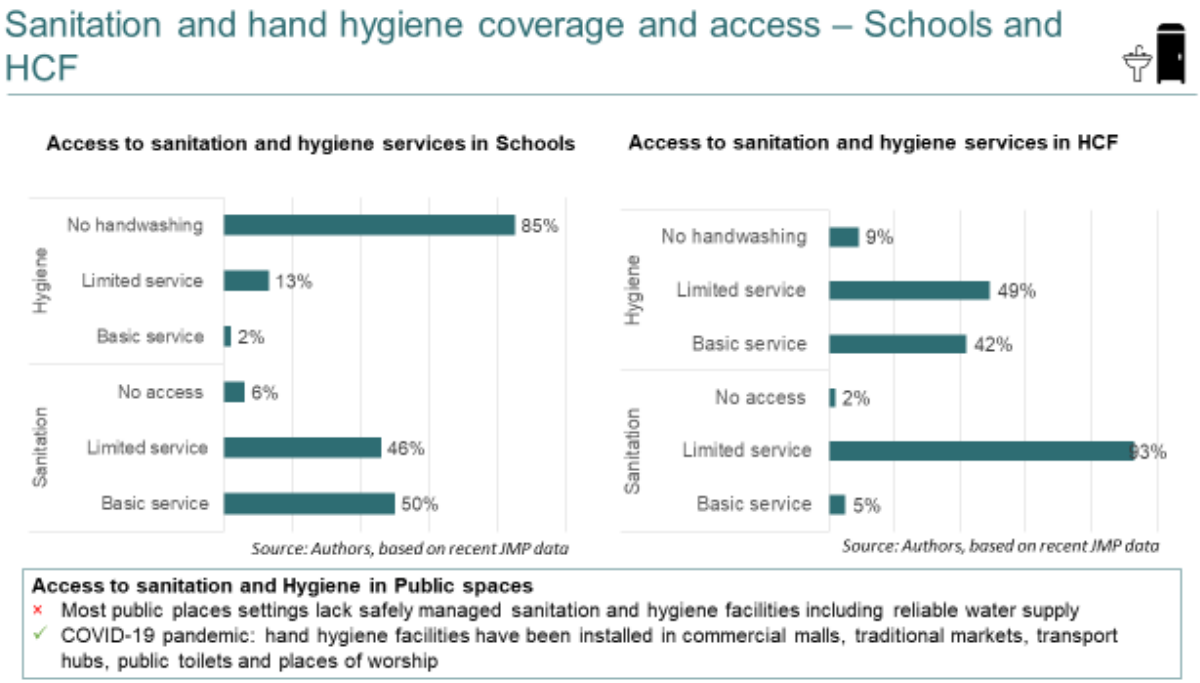


**Figure 2.6: Sanitation and Hygiene Coverage**. Source: JMP

### 2.3.4: Sanitation Status of Marsabit County

Marsabit is the largest county in Kenya, covering approximately 70,961km$^2$. The county has a population of 291,166 people and is divided into the following 4subcounties Moyale, North Horr, Saku, and Laisamis (KBS, 2015). Nomadic pastoralism is the only form of productive land use

that is truly viable in the county, and it accounts for 97% of the land use; hence its the predominant source of livelihood for the population. Arable farming is restricted to the remaining 3% of the district's land area where crop production is mixed with animal rearing (UNICEF & USAID Report, 2016).

Governments, NGOs, and communities themselves have focused mainly on water supply and paid very limited attention to community sanitation. As a result, access to improved sanitation is extremely low, with only 35.4% of the households having access to improved sanitation compared to the national average of 55% in urban areas (WHO Report, 2021).

As much as some households in Marsabit town have flushable toilets, the majority use shared pit latrines or practiced OD. The Nomadic communities in the county rely mainly on OD in the surrounding bushes (Mwai et al., 2012). A smart survey report established that the Laisamis sub-county recorded the highest proportion of 77% of the population practising OD,75.3% North Horr and Moyale recorded 51%, which was the lowest (UNICEF& USAID Report, 2016).

A study conducted by the water Sanitation program and MoH established that 64.6% of the population in Marsabit practice OD while only 15% have access to improved sanitation. This causes the county to lose approximately 332 million Kenya Shillings each year due to poor sanitation loss related to healthcare costs and productivity, premature deaths, and time lost (WSP and MoH Report, 2014).

Jaro et al. (2023) concentrated on WASH, acknowledging its critical significance in health and longevity in a nomadic community. Increases in bacteria like E. coli that cause illness are a result of poor sanitation. The primary goal was to look at the E. coli contamination of the milk and water

in this nomadic group. The researchers collected water and milk samples as part of a cross-sectional study they carried out to do this. The contamination levels were calculated using the most likely number method, paying close attention to the community's inadequate sanitation standards.

The study's findings showed that the water pathway was the main way that E. coli was exposed to the environment, which suggested that the bacteria was present in substantial amounts. Similar to the pan and borehole feed water tanks, 20% of the dam water samples had E. coli contamination. Additionally, the pan water sources had 1.93 x 104 CFU/ml of E. coli while the tested dam water sources had 1.05 x 107 CFU/ml. Both of these values were higher than the recommended E. coli concentration in water (10–40 CFU/ml).

According to the study's findings, the nomadic lifestyle's poor sanitation standards have resulted in a significant microbiological contamination issue. As a result, it highlighted the need for a complex sanitation system that is especially suited to the requirements of the pastoralist population. The creation of such a model would be crucial to reducing the continuous problem of recurring fecal pollution in water sources for the Turbi ward population.

Several restrictions had an impact on the study's conclusions, which were intended to examine E. coli contamination of milk and water in a nomadic group and its relationship to subpar sanitation. Only one nomadic community in a particular geographic area was the subject of the investigation. The results might not apply to other nomadic communities or areas with various environmental and cultural elements. Additionally, with only 50 samples for each water source, the study's sample size appears to be rather tiny. Results that are more solid and trustworthy would come from a bigger sample size. The study also lacks a control group. It is difficult to prove a direct correlation

between poor sanitation and E. coli infection in the absence of a control group. Comparing pollution levels in areas with various sanitation procedures may have benefited from a control group. Additionally, the study's cross-sectional approach offers a glimpse of contamination levels at a particular period. Examining the trends and shifts in contamination over time would have been more useful with a longitudinal study approach.

The report also does not have a thorough analysis. The study did not take into account other potential pathogens or contaminants in milk and water that can increase overall health risks because it only focused on E. coli contamination. Additionally, the study falls short in its discussion of potential confounding variables like weather, the presence of livestock, and human behavior that may affect the levels of E. coli contamination. The report draws attention to the issue of subpar sanitation, but it doesn't offer any concrete suggestions or solutions for how to solve the problem. Notably, the report makes no mention of any ethical review or participant informed consent, which are essential components of any study involving human subjects. Last but not least, it seems that the study's conclusions oversimplify the complexity and diversity of nomadic tribes as well as their sanitation techniques. In conclusion, even though the study's findings point to an alarming level of E. coli contamination linked to poor sanitation in the investigated nomadic community, the study could be improved by addressing the mentioned limitations and ensuring a more thorough and robust methodology to support its findings.

**2.3.5: Sanitation Status in Kilifi County**

Kilifi County has a population of 1,109,735 people, with only 25.9% of the population having access to improved sanitation facilities and 34% practising OD. This is according to the county sanitation profile report developed by the WSP program in 2014 (WSP/MOH Reports, 2014).

According to a UNICEF report, a significant portion of households are still defecating in bushes and other open areas. The prevalence of OD was 28.9% among the investigated families. About 50.8% of households had their own toilets, compared to 20.4% who shared facilities or used their neighbors' lavatories (EU, UNICEF, and International Medical Corps reports, 2018). People continue to urinate in the open in rural areas, including Kenya's Marsabit and Kilifi counties (15% against 3% in urban areas), primarily because open land is available but also because in some places it is regarded as culturally acceptable (Ndungu et al., 2018).

According to the MOH's Kenya Environmental Health and Sanitation Policy from 2016, the northern counties, particularly Wajir, continue to have very high rates of OD, which is also associated with high poverty levels. Resources become scarce as a result of the population's constant growth, and the effects of improper human waste disposal start to manifest. According to the Wajir County Government, UNICEF, and Save the Children (2018), this is especially true for populations that rely on unprotected surface water sources like water pans or shallow groundwater sources. The difficulty is considerably greater in metropolitan areas where population expansion is outpacing the availability of essential amenities, such as sanitation. Urban planning rarely occurs before settlement, which makes it considerably more difficult for utilities to offer water and sanitation services. Additionally, having a toilet, whether or not it is connected to a piped wastewater system, is only one aspect of managing feces (Ndungu et al., 2018).

### 2.3.6: Consequences for Lack of Adequate Sanitation

Disease is caused by poor sanitation, as Chadwick's landmark "Report on an inquiry into the sanitary condition of the laboring population of Great Britain" (Chadwick et al., 1842) made scientifically clear for the first time. The BMJ (British Medical Journal) readers' selection of sanitation as the most significant medical advancement since 1840 in 2007 gave a less rigorous scientific but nonetheless professionally meaningful signal of the impact of poor sanitation on human health (Ferriman et al., 2007).

According to Pruss-Ustun and Bos (2008), diseases brought on by poor sanitation alone account for 10% of the world's illness burden. These diseases are particularly linked to poverty and infant mortality. The most hazardous to your health are feces. As many as $10^6$ viral pathogens, $10^6$–$10^8$ bacterial pathogens, $10^4$ protozoan cysts or oocysts, and 10-$10^4$ helminth eggs can be found in one gram of fresh feces from an infected person (Lane et al., 2010). Pathogens, particularly those found in unsafe drinking water, tainted food, or filthy hands, are the main causes of diarrhea. The spread of these infections is facilitated by poor hygiene and sanitation. The causes of 88% of diarrhea cases globally include contaminated water, poor sanitation, or poor hygiene.

Each year, these incidents result in 1.5 million deaths, the most of which are those of children. Cholera, typhoid, and dysentery are some of the more serious illnesses that fall under the umbrella term "diarrhea" and all have associated "faecal-oral" transmission pathways (Bos et al., 2008).

Additionally, poor sanitation, hygiene, and water are responsible for around 50% of the negative impacts on children and maternal underweight. This is because there is a connection between diarrheal infections and undernutrition, where being exposed to one increases susceptibility to the other. Several African nations, including Kenya, failed to achieve the MDG target of reducing the proportion of people without sustainable access to safe drinking water by half. Consequently, there

was a rise in the occurrence and reappearance of diseases associated with poor sanitation, such as diarrhea, dysentery, hepatitis A, typhoid, polio, intestinal worms, schistosomiasis, and trachoma. Malnutrition can also be attributed to inadequate sanitation. The implementation of the MOH Health Policy, 2016 will hinder the achievement of the existing SDGs (MOH Health Policy, 2016).

### 2.3.7: Diarrheal Disease Burden Associated with Sanitation in Children Under Five Years

The SDGs has heightened awareness of the contributions of non-health sectors in improving children's health. Interventions that improve access to WASH can effectively prevent the spread of infectious diseases and improve nutritional status. These interventions are crucial for promoting child health and welfare (Darvesh, 2017).

The well-being and growth of children rely on their ability to obtain uncontaminated water, sanitary facilities, and proper hygiene practices. Most victims are predominantly children under the age of five, as they are more susceptible to waterborne diseases, namely diarrhea. Although progress has been made in reducing the number of deaths caused by diarrhea, there are variations in the occurrence and severity of the ailment based on geographical and socioeconomic factors (Fewtrell & Kaufmann, 2005). Environmental enteropathy, also referred to as early pathogen exposure, is commonly recognized as being linked to elevated rates of stunting and diarrheal burdens. WASH conditions and treatments can have adverse effects on the growth and development of children in various ways. It is widely accepted that improving the WASH conditions for underprivileged children worldwide is crucial in order to prevent malnutrition (Arnold & Colford, 2007).

Although mostly preventable, diarrheal diseases account for 9% of all pediatric deaths worldwide (Liu et al., 2015). In 2013, about 580,000 children lost their lives, resulting in an average of 1,600

children dying from preventable diarrhea each day. The regions of South Asia and sub-Saharan Africa have the highest concentration of children under the age of two who experience mortality due to diarrhea, according to the World Health Statistics Reports of 2015. Diarrhea remains the second leading cause of mortality among children under the age of five on a global scale. About 1.5 million children each year, or nearly one in five child fatalities, are caused by diarrhea. More young children die from it than from AIDS, malaria, and measles put together. According to estimates from the WHO and UNICEF (2009 Reports), contaminated water, inadequate sanitation, and poor hygiene are to blame for 88% of diarrheal fatalities globally.

An international study found that five or more episodes of diarrhea in the first two years of life could be the cause of 25% of stunting in 24 month-old children. Additionally, stunting and malnutrition can result in subpar academic performance, early school abandonment, and a subsequent poorer level of economic well-being in later life (Checkley & Buckley, 2008).

Due to their smaller size, milder odor, and lack of obvious food remnants, many cultures view the feces of newborns nourished on breast milk as innocuous or less dangerous than those of adults (Gil & Lanata, 2004). Young children may also be unable to use a toilet or latrine due to their developmental stage and safety concerns, even if their home has access to one. As a result, their feces are dumped outside, which adds to the high burden of diarrheal disease (UNICEF &WSP, 2014).

Around the world, more than 125 million kids under the age of five reside in homes without access to a better source of drinking water. Over 280 million young children under the age of five reside in homes without access to better sanitary facilities. Due to the absence of access to safe drinking water and basic sanitation, each of these children is an individual whose rights are violated and

whose health is put in danger from birth (UNICEF, A report card on water and sanitation; Progress for children, 2006). Every child's and every community's health depends on access to safe water, adequate sanitation, and hygienic practices; these factors are therefore crucial to the development of communities that are stronger, healthier, and more just. Giving the most disadvantaged communities and children better access to these programs today increases their chances of a better tomorrow (UNICEF, 2017).

### 2.3.8 Cholera as an Example of Diarrheal Disease Burden Associated with Poor Sanitation

#### 2.3.8a Epidemiology of Cholera in Kenya

One of the 36 priority diseases listed in Kenya's new Integrated Disease Surveillance and Response (IDSR) strategy 2021, cholera is still a significant public health concern. The cholera pandemic that started in South East Asia in the 1960s was linked to the first cholera outbreak in Kenya, which occurred in the Turkana District in 1971. There has been an increase in cholera incidence across the nation, with major cyclical outbreaks lasting two to three years and happening around every five to seven years. Large-scale cholera epidemics of note happened in 1997–1999, 2007–2010, and 2015. Kenya has seen outbreaks every year over the previous seven years, with the largest number of cases (17,230) recorded in 2015, a decline in 2016, and an upward trend from 2017 to 2019 as shown by the epi curve (figure 3). A total of 711 cases (CFR 1.8%) were reported in 2020, while 38 cases (with no deaths) were reported in 2021. Two refugee camps were the reported sites of the 2021 outbreak.

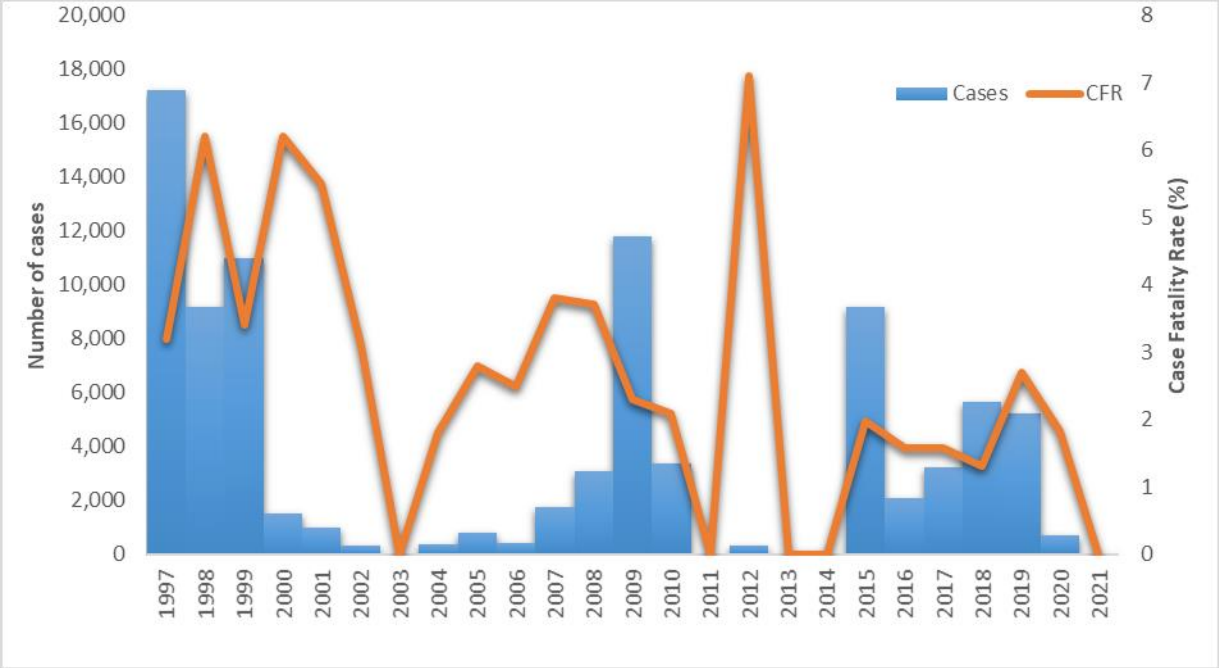


**Figure 2.7: Number of Annual Cholera Cases and Case Fatality Rate, Kenya, 1997-2021** (MoH, 2022).

**Table 2.1: Number of Reported Cholera Cases, Number of Deaths and Case Fatality Rate — Kenya, 1997–2021**

| Year* | Number of cases | Number of deaths | Case Fatality Rate (%) |
|---|---|---|---|
| 1997 | 17200 | 555 | 3.2 |

| | | | |
|---|---|---|---|
| 1998 | 15937 | 994 | 6.2 |
| 1999 | 10964 | 368 | 3.4 |
| 2000 | 1509 | 93 | 6.2 |
| 2001 | 1001 | 55 | 5.5 |
| 2002 | 319 | 10 | 3.1 |
| 2004 | 392 | 7 | 1.8 |
| 2005 | 828 | 23 | 2.8 |
| 2006 | 402 | 10 | 2.5 |
| 2007 | 1756 | 67 | 3.8 |
| 2008 | 3091 | 113 | 3.7 |
| 2009 | 11796 | 274 | 2.3 |
| 2010 | 3354 | 72 | 2.1 |
| 2012 | 338 | 24 | 7.1 |
| 2013 | 41 | 0 | 0.0 |
| 2015 | 17230 | 182 | 1.1 |
| 2016 | 2103 | 33 | 1.6 |
| 2017 | 3228 | 51 | 1.6 |
| 2018 | 5638 | 74 | 1.3 |
| 2019 | 5208 | 141 | 2.7 |
| 2020 | 711 | 13 | 1.8 |
| 2021 | 38 | 0 | 0.0 |

*No cholera cases were reported in 2003, 2011 and 2014

### 2.3.8b Identified Risk Factors for Cholera Outbreaks in Kenya

The following have been identified as factors connected to cholera outbreaks, according to numerous research and epidemic investigations carried out in Kenya in recent years;

**1. OD**. According to Cowman (2017), districts with a higher frequency of OD are more likely to experience cholera epidemics.

**2. The High Population Density in Urban Slums**. Population growth in urban and slum areas without appropriate expansion of the infrastructure for providing access to clean water (World Bank, 2015).

**3. The Cross-Border Movement of People.** Movement of persons from nearby nations that are dealing with severe situations and significant cholera outbreaks contributes to more outbreaks. Between 2015 and 2018 it was discovered that the areas bordering Somalia's neighbor had the greatest mean annual incidence of cholera (Mutonga, 2013).

**4. Transmission Among Displaced People and in Crowded Environments.** Multiple protracted outbreaks continue to occur in the Kenyan refugee camps. 23% of all reported cases in 2017 were transmitted in camp settings, mostly in the counties of Garissa and Turkana. Large refugee camps, Dadaab and Kakuma, are located in both counties. These camps house refugees from neighboring nations (Mwenda, 2017). Following the contentious 2008 presidential elections, there was widespread civil disturbance and large population displacement, which led to a surge in cases reported from 2008 to 2010 with abnormally high mortality.

**5. Public Gatherings at Buildings, Eateries, and Motels**. In 2017, 7% of cases took place in institutions and large gatherings where many individuals contracted the disease from a single primary cause. Following a field study, the outbreak was determined to be a point source, with 146 victims having eaten chicken from the hotel, and it occurred in June 2017 among guests at an international conference in a hotel in Nairobi County. Vibrio cholerae serotype, Ogawa,

proven by culture. 136 cases of cholera were reported between July 10 and July 12, 2017, while a trade show was taking place in Nairobi County.

**6. Modifications to Rainfall Trends**. In Kenya, there was a strong correlation between an increase in cholera risk and both an increase in rainfall from October to December and a reduction from April to June (Stoltzfus et al., 2014).

### 2.3.9: Population Awareness on Sanitation Issues

The gap between knowledge, practice, and attitude has made access to better sanitation and water management methods a global challenge (Wesonga et al., 2016). People in India who had any exposure to them and recognized their benefits embraced latrines. For instance, women who had grown accustomed to using the bathroom at their parents' house preferred to have one at their in-laws' house, which they moved into after getting married. Others had access to latrines in metropolitan settings while pursuing their formal education through hostel stays or visits to relatives who owned latrines (Routray & Schmidt, 2015).

Following the adoption of CLTS, community awareness of the significance of sanitation behaviors, such as OD, latrine use, and handwashing, greatly increased in Zambia. In general, participants had a high level of knowledge of the connection between better hygiene and sanitation practices and health. When asked how flies could spread diseases from unsecured feces to food, almost all household leaders and students could explain (Joseph, 2016). Safe water and improved sanitation are still far from being achieved despite initiatives by governments and other partners, particularly in peri-urban areas of developing nations where services tend to omit low-income informal settlements (UN-HABITAT, 2011). The improvement of community health is the

primary objective of organizations engaged in sanitation programming, according to a study done in Benin. However, despite the benefits to their health, households hardly ever adopt and use toilets (Benin MOH Report, 2018).

Health-related factors were quite insignificant and had minimal impact on the containment of faecal-oral infections. The primary motivations for adopting and utilizing sanitation practices include the desire to be contemporary, maintain privacy, avoid humiliation, seek convenience, and minimize the inconveniences or hazards of outside environments such as snakes, pests, and rain. Additionally, the aspiration for social acceptance and elevated social standing also plays a significant role in driving the adoption and use of sanitation facilities (Jenkins & Curtis, 2005). In Ghana, the decision to install a household toilet is influenced by several factors. These include the level of satisfaction with present defecation practices, the incentive to improve sanitation, the priority given to competing household issues, and the limits connected to the situation and execution. This leads to a rise in the need for sanitary facilities (Jenkins & Scott, 2007).

An investigation conducted in a Nigerian urban slum environment revealed that 78% of the participants believed that the water accessible to them was suitable for consumption. Additionally, 95% of the individuals acknowledged that the water's quality may impact their well-being. However, only 45% of the respondents utilized latrines for defecation. Furthermore, a significant majority of 83% of the participants identified gastrointestinal tract infection as the prevailing consequence of consuming untreated drinking water. Each individual diligently cleansed their hands prior to touching meals. The author's conclusion emphasizes the necessity of creating educational programs that focus on families and aim to increase knowledge about affordable and readily available water treatment methods (Prasad et al., 2014).

Kenyan cities are currently unable to meet the significant demand for sanitation services due to rapid urbanization. More than 15 million urban residents do not have access to adequate sanitation services, and this figure is increasing. There is a need for more thorough examination of urban areas, including the creation of technical solutions and investments that are acknowledged and endorsed (MOH, 2017). A survey conducted in Nyanza found that 77.9% of the homes possessed soap, however, only 7% placed the soap near the restroom for the purpose of hand washing after use (Wesonga et al., 2016). Individuals with higher levels of health literacy demonstrate a greater willingness to invest in the enhancement of sanitation services. Increased awareness of the negative effects of unimproved sanitation leads to a higher likelihood of individuals being willing to pay for the service (Nguyen, 2013).

### 2.4: General Factors Influencing Access to Sanitation

A study conducted in Mali following a CLTS intervention found that the proportion of households with access to a private restroom increased significantly. Specifically, the percentage of households with access to a private restroom nearly doubled in CLTS villages, going from 33% at the beginning of the study to 65% in the intervention group during the follow-up period. Furthermore, the implementation of CLTS resulted in a significant increase in latrine ownership, with a rise of 39%. (Pickering, 2015). A meta-analysis examining the effects of sanitation campaigns found that CLTS often leads to a 6-12% increase in latrine coverage, with the potential for an increase of up to 30% (Garn, 2017).

A cluster randomized control trial conducted in Ghana found that the implementation of CLTS interventions resulted in a 67.6% increase in latrine coverage in the intervention regions, whereas the control areas only had a 7.9% increase. The impacts of CLTS on latrine building were strongly

mediated by changes in four factors. The mentioned factors include the behavior of others, approval from others, one's belief in their own abilities, making plans for action, and dedication to follow through. The installation of latrines was favorably correlated with changes in vulnerability, severity, and barrier planning, but it was not influenced by CLTS (Harter, 2020).

### 2.4.1: Social-Economic Factors Influencing Access To Sanitation

A healthy lifestyle, decent hygiene, and access to clean water are essential for social and economic advancement. The Indian Prime Minister in 2008 cited Mahatma Gandhi's 1923 statement that "sanitation is more important than independence" as the reason for this (Singh, 2008). Among the many financial advantages of improved cleanliness are the direct financial advantages of avoiding sickness (the amount of money saved on medical bills). On the contrary, it has indirect economic advantages like fewer sick days missed from work and a longer lifetime. These advantages allowed people to work more and provided non-health advantages like time (Hutton, 2007).

For both global and local action on sanitation, economic factors are a key factor. For every dollar spent on sanitation, there is an approximate nine-dollar long-term value in costs avoided and productivity increased. According to the UN Economic and Social Council (2010), providing access to clean water and sanitation has the potential to enhance employment and improve health, education, and literacy.

A number of problems have slowed down sanitation improvement in Rwanda. Particularly, it was claimed that a shortage of funds was the primary cause. Low income and the inability to accumulate money for longer-term sanitation facilities greatly limit people's options (Tsinda & Abbott, 2013). According to a desk study conducted by the World Bank's Water and Sanitation Program, Kenya loses 27 billion Kenyan Shillings ($324 million) annually. According to the Water

Sanitation Program (2012), this amount is equal to $8 USD per person in Kenya per year, or 0.9% of the country's GDP.

Approximately half of the rural population in Kenya lacks access to rudimentary sanitation facilities. The level of access to improved sanitation has shown minimal improvement since 1990, with an increase of only 4% from 25% in 1990 to 29% in 2013 (MOH, ODF Framework, 2016). Additionally, each Kenyan who uses OD spends nearly 2.5 days a year looking for a private place to urinate, resulting in significant financial losses (Water Sanitation Program, 2012). Unexpectedly, women bear the brunt of this expenditure because they tend to spend more time with sick or elderly relatives as well as young children and sick youngsters. In Kenya, the availability of sanitation varies greatly. High levels of poverty are directly correlated with various regions of the country with poor sanitation coverage. Compared to rural areas, urban slums, and informal settlements, planned urban areas receive greater service. Kenya loses US$ 88 million a year to OD; but, to end the practice, fewer than 1.2 million latrines would need to be constructed. OD is the most expensive unimproved sanitation practice, costing more than 17 USD per person annually (MOH, ODF Framework, 2016).

Apart from cultural practices, other factors that contribute to the lack of these sanitary facilities in families include poor soil formation and economic factors. Since the construction process begins from the hole on loose soils, more materials are needed to build a latrine that can survive the whims of the weather. This entails lining the hole from the bottom up, which is the same as constructing two latrines. A hamlet in Nyakach Kisumu County claims the cost is too high, so instead of building latrines, which collapse during the rainy season, they turn to the "cat" approach (Wesonga et al., 2016).

### 2.4.2: Socio-Demographic Factors

Over a billion people practice OD worldwide, according to the Statement of the Committee on the Right to Sanitation (45th session, E/C.12/2010/1) of the United Nations Committee of Social, Economic and Cultural Rights. The statement emphasizes how many places in the globe lack bathrooms or bathrooms for females, which prevents them from attending school (UN, Economic and Social Council, 2010).

Cultural norms strongly influence sanitation and even the possibility of discussing sanitation. Excreta management is taboo in many cultures because it is seen as disgusting or a hazardous annoyance that should not be discussed. Excreta is something no one wants to be connected with (WHO, UNICEF, & WSSCC, 2000).

Rural residents in India, including those with government-subsidized latrines, have their own explanations for continuing to practice OD due to gaps in the sanitation assistance provided by the government. Many people did not use their government-funded latrines because they were improperly constructed, occasionally had no roof, door, or walls, or the pits were too tiny (Routray & Schmidt, 2015). The lack of a water source in or near the toilet was a significant issue in societies where people were washers (using water for anal cleansing and post-defecation ceremonial bathing). Reason for not using publicly funded latrines, which forces people to urinate outside close to water sources (Routray & Schmidt, 2015).

Water supply and sanitation programs implemented by the government are based on the needs and preferences of the community. The administration of these programs is impacted by sociocultural norms and gender perspectives. However, it is important to note that the water supply and sanitation facilities in villages are not sustainable in the long run (Terah, 2002). Up to 30 to 50

percent of WASH projects fail within the first two to five years, making it clear that these programs typically fail to provide the people they aim to serve with long-lasting benefits. Universal access to services is severely hampered by the absence of sustainability in WASH measures, which has disastrous effects on people, economies, and the environment (UNDP Water governance facility/UNICEF, 2015).

Water-borne infections, which are widespread in Kenya, are frequently caused by poor hygiene habits, a lack of access to sanitary facilities, and a reliance on unprotected water sources. Due to poor sanitation and hygiene standards and the use of contaminated water, cholera epidemics in this country have increased recently, especially in the Lake Victoria Basin (Olago et al., 2007).

Over 43% of Kenya's rural population lacks access to basic sanitation, which is partly linked to socio-cultural problems. According to the Kenya Demographic Health Survey from 2008, 21 million Kenyans use unhygienic or communal latrines. According to the MOH's Kenya Environmental Health and Sanitation Policy (2016), OD is almost exclusively associated with poverty; more than 60% of those in the wealthiest quintile use it compared to less than 1% in the poorest quintile. According to a Nyanza study, the cost of construction, level of poverty, and soil quality all have an impact on latrine use. Due to the high cost of building latrines and the fact that many community members are poor, the majority of them were unable to do so. In this study, the majority of latrines were built by men, and sharing them with in-laws and older kids was not allowed. Because it was thought that washing one's hands would make one lose the ability to raise animals, hand washing was not practiced (Wesonga et al., 2016). The development of socially, economically, and ecologically sustainable sanitation systems must adhere to three key principles:

equity, health promotion, illness prevention, and environmental protection. Sanitation systems must not harm ecosystems or use up limited resources.

### 2.4.3: Gender and Equity in Sanitation

In 80% of households with a male head of family, choices on building household-level sanitary facilities were made without any input from women; in 11% of households, men made the decisions after consulting or otherwise including women. Women made the choice in just 9% of families (Routray & Torondel, 2017).

In order to overcome the specific barriers preventing individuals from accessing and using services sustainably, such as adopting hygiene habits and safe sanitation, they need to be treated differently and given the appropriate assistance and interventions (Narayanan et al., 2011). The SDGs pledge to provide universal coverage, reaching every person and leaving no one behind. This is a departure from the Millennium Development Goals (MDGs), where governments, intermediaries, and organizations pursued general coverage without taking into account the requirements of varied populations, such as the disabled and those with limited mobility (UNSCEB, 2017). There is also a significant gender component because women and girls experience the greatest suffering, including the risk of sexual assault when open defecating in the dark outside of the hamlet. Furthermore, according to Narayanan et al. (2011), the wealthiest 40% have ten times greater access to improved sanitation than the poorest 40%.

Most frequently, women and girls are the household's principal water consumers, suppliers, managers, and keepers of hygiene. Women must go vast distances and spend a lot of time traveling if a water infrastructure is in poor condition (Water Sanitation Program, 2010).

Poor women and girls are disproportionately affected by inadequate access to sanitation and hygiene because they frequently experience extra difficulties relating to menstrual hygiene, personal safety, sexual harassment, and violence. Many women and girls who lack access to lavatories end up living as "prisoners of daylight," only using the night for seclusion. They run the risk of being physically attacked and sexually abused when they travel at night to fields or by the sides of the road (Sida, 2015). Additionally, dropout rates are much higher and females are less likely to attend school in many nations where there is no access to clean water or separate restrooms for boys and girls (Sida, 2015). The study also found that households with more involved women in general decision-making were less likely to construct latrines than those with more excluded women. Due to their poor socioeconomic standing and incapacity to have an impact on the household's financial decisions, women were not involved in decision-making about sanitation (Routray & Schmidt, 2017).

According to a study done in the Nyakach Kisumu County, the man of the house is mostly responsible for building latrines. However, while he is away, craftsmen are hired to build one or get help from the brother's in-law. Old mosquito nets, reeds, polythene sheets, iron sheets, mud, bricks, and cement mortar were found to be the most frequently used materials for latrine superstructure building (Wesonga et al., 2016). It is well known that sanitization and sustainable management of water resources benefit society and the economy greatly. In order to address the unique requirements and concerns of women and men from all social groups, it is crucial to first include both men and women in the administration of water resources and sanitation policies (UN-Water & IANWGE, 2005-2015).

In order to give women and girls more time to pursue education, generate revenue, and even build and operate water and sanitation infrastructure, clean water must be physically accessible (UN-Water & IANWGE, 2005-2015). The new SDGs aim to eradicate OD and achieve universal access to basic services by 2030 (WHO, 2017) in order to reduce global inequality.

### 2.4.4: Willingness and Ability to Pay for Sanitation Facilities

The need for demand-driven sanitation programs has become more widely acknowledged over the past 20 years, but there is no data on how many rural inhabitants in developing nations are ready to pay for sanitation upgrades (Hall & Vance, 2015).

Sanitation, as defined by the WHO, refers to the provision of facilities and services that ensure the safe disposal of human excrement and urine. Enhancing sanitation has been scientifically demonstrated to exert a significant beneficial impact on health, both at the household level and among communities. Poor sanitation is a significant factor in the spread of diseases globally. Sanitation, as defined by the WHO (2018), encompasses the management of hygienic conditions, including waste disposal and rubbish collection. The obstacle of assessing the readiness and capacity to implement sanitation practices at the household level persists, even when there is a high degree of awareness and coverage of sanitation (Ouma et al., 2017).

The ability to acquire appropriate financial resources and purchase or build a sanitary facility might demonstrate a community member's willingness. The ability and willingness to fulfill this goal are frequently influenced by the availability of resources (Ouma et al., 2017). Individuals are more inclined to be willing to compensate for a service when they possess knowledge about the expenses linked to using inadequate sanitation (Nguyen, 2013). Despite the government's financial constraints, it is unable to provide heavily subsidized modern sanitation facilities to a significant

portion, or even the majority, of its people. Consequently, numerous impoverished nations lack access to contemporary sanitation infrastructure. Consequently, the enhancement of sanitation conditions in these countries is largely dependent on the financial contributions made by households. This, in turn, is influenced by each household's willingness to pay (WTP) and their financial capability to afford the improved sanitation services. The concept of Willingness to Pay (WTP) generally refers to the economic value that an individual or family assigns to an item or service under given circumstances (Russell et al., 1995).

Improved health may seem to be the most obvious benefit of sanitation. Still, other gains such as privacy and safety, convenience, and comfort are no less important. They make even the poor people willing to pay for basic sanitation because of such benefits (Water Sanitation Program, 2004). An investigation carried out in Kabarole District, Uganda, revealed that approximately 83% of families expressed willingness to spend a minimum of $3 for an enhanced sanitary toilet. Most individuals (78%) expressed a preference for personal ownership of their restroom rather than communal ownership. The level of willingness to pay was substantial, reaching 66%. A majority (62%) expressed a readiness to make payments in installments over a period of three months. The primary motivation for this desire was related to health, possibly indicating a connection to sickness. Reasons cited for the unwillingness to pay included a lack of money, as well as the belief that their existing sanitation facility was fulfilling its intended function (Francis, 2015).

In a separate survey carried out in Bangladesh about willingness to pay (WTP), almost 82% of the families expressed a desire to financially contribute towards the installation of a new sanitary latrine. Among these homes, the majority (73%) indicated a preference for having their own toilet. The extremely favorable reaction of the heads of households was taken into account within the

framework of the criteria specified while constructing the hypothetical scenario for value assessment. One criterion that was included was the availability of payment options in the form of monthly installments. According to Seraj (2008), around 92% of the respondents who were interested in the topic expressed a preference for making payments in monthly instalments. A 2017 study conducted in Busia, Kenya, revealed that sanitation has a broader impact than only enhancing health and economic outcomes. These encompassed additional intangible effects, which are challenging to quantify, and are frequently omitted in many research. The essential elements encompassed in this list are dignity, comfort, privacy, security, and social acceptance. This comprehension should motivate any members of a community to be more inclined to invest resources towards sanitation. The studied community exhibited a significant inclination to allocate resources towards sanitation, with 87.5% expressing readiness. However, this enthusiasm did not correspond to comparable levels of capability. The significant level of willingness can be attributed to the elevated levels of awareness regarding sanitation, primarily disseminated by the Community Health Volunteers (CHVs) who are easily accessible within the community (Ouma et al., 2017).

Individuals with higher health literacy had a greater willingness to invest in the enhanced sanitation service. Increased awareness of the negative effects of utilizing inadequate sanitation facilities leads to a higher likelihood of individuals being willing to pay for improved sanitation services (Nguyen, 2013). A community in Ethiopia demonstrated a willingness to contribute 1.54% of their disposable money towards enhancing sanitation. Several factors influence an individual's willingness to pay, such as income, previous spending on sanitation, awareness of the health consequences of poor sanitation, knowledge of different types of sanitation, attitude towards sanitation, the number of households sharing a toilet, monthly savings, and the number of years

lived in the current residence. These factors have a significant correlation with the amount of willingness to pay (Kefale, 2016). A recent initiative, financed by The World Bank Development on Marketplace, identified four approaches to enhance sanitation accessibility in impoverished communities in Bolivia. The tactics involve the development of cost-effective sanitation models, analysis and promotion of consumer demand, establishment of small sanitation enterprises to meet this need, and implementation of microcredit systems to facilitate financing for sanitation purchases (Moe & Gangarosa, 2009).

## 2.5: Sanitation Gap Worldwide

There is an enormous gap between these assessments recommend financial externalities related to sanitation, which makes the burden a lot more noteworthy and conspicuous than the expense of specific cases. Both the extent of the burden and the media in which sanitation influences the pay are significant for the playmakers. The researcher followed this gap, looking at various instruments through which Sanitation and CLTS can influence long-term financial improvement, (Worldwide Health Technical Assistance Project, 2011).

## 2.6 Sanitation Gap in Africa

The sanitation and CLTS gap in Africa contrasts the appraisals of the financial burden getting from microeconomic investigations, and macroeconomic cross-country relapses give understanding into the systems in which malaria hinders improvement (Patrick, 2017).

## 2.7: Sanitation and CLTS Gap in East Africa

The prioritization of public health and overall economic outcomes in relation to sanitation and CLTS practices is once again emphasized as crucial for addressing the sanitation gap in the East African population's development. There has been extensive speculation over whether human-caused environmental change is contributing to the problems of sanitation and CLTS, especially in places characterized by both high and low temperatures (UNICEF, 2002).

## 2.8 Sanitation and CLTS Gap in Kenya

In Kenya, there is a significant disparity in sanitation and CLTS, which poses a higher risk for poor individuals in terms of both contracting communicable diseases and experiencing more frequent infections. The rates of infection and death, particularly among children under the age of

five, are greater in disadvantaged families. Sanitation plays a significant role in causing a substantial portion of these deaths (Neghinaet et al., 2010).

### 2.9 Sanitation and CLTS Gap in Kilifi and Marsabit Counties

The Sanitation and CLTS gap in Kilifi and Marsabit has affected the poor management and the ignorance of the population on sanitation and CLTS control due to a number of factors such as corruption, the inadequacy of the health services, limited financial resources, lack of skilled health care providers or healthcare employees and the low community awareness or mobilization of resources in the selected Counties in Kenya (Bodeker, 2004).

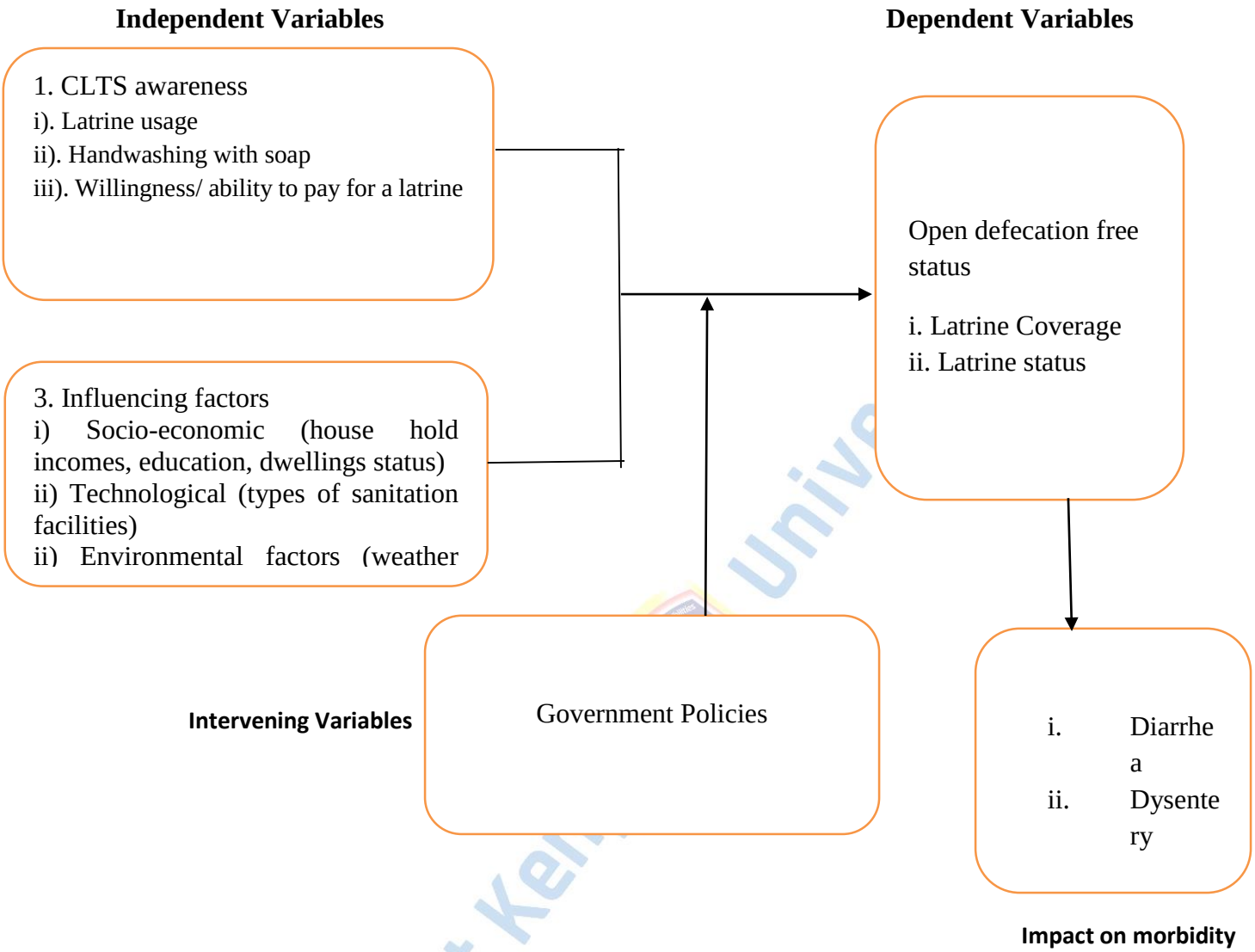


**Figure 2.7: The Conceptual Framework**

### 2.10.1: The Summary of the Conceptual Framework

### 2.10.2: Independent Variable

In this study, the independent variables were:

### 2.10.3: CLTS Awareness

Sanitation, water supply, and health are three factors that are closely related to determining the sanitation levels in a community. Inadequacies in any of these three aspects cause several diseases and deaths globally. One factor that determines the success of these factors is knowledge. It is critical to determine the difference in behaviour and sanitation outcomes between people who have good knowledge of sanitation and its impacts on health and those who have little knowledge about the same.

### 2.10.4: Morbidity of Diseases

The burden of diseases associated with sanitation is a key indicator of the effectiveness of CLTS in the two counties, due to the attribution of the methodology in sanitation and hygiene. County records health information records on morbidity from diarrhoea, dysentery and malaria were examined. They provided an indicator of the attribution of CLTS to sanitation-related infections in the county.

## 2.11: Major Factors Influencing CLTS Implementation

This study examined the main barriers and enablers to CLTS in both counties and correlate and corroborate them, to the performance of the counties in the CLTS activities and ODF in general. Investigated parameters include socio-economic (house hold incomes, education, dwellings status), technological (types of sanitation facilities), and environmental factors.

This research focused OD (Proportions) and ODF (Latrine Coverage and Latrine status, as dependent variables in the two study counties, while government policies put in place for CLTS implementation were the intervening variables.

# CHAPTER THREE: METHODOLOGY

## 3.1: Introduction

This chapter consists the research design, approach of the study, study location/areas, target population of the research, criteria of the study, sample techniques of the study, sample size determination of the study, data collection instruments, data analysis and presentations, and ethical considerations of the study.

## 3.2: Research Design

The study adopted a comparative study design. It also included an analytical cross-sectional study design to ensure a proper description of the study variables and to bring out the real situation of CLTS among the two communities properly describing the differences in the effectiveness of CLTS in the two counties.

## 3.3: Study Approach

The study design used a quantitative approach. Quantitative data for key parameters was recorded after the intervention phase and compared to quantitative baseline data fetched from secondary sources.

## 3.4 Study Location

The study was carried out in Kilifi and Marsabit Counties in Kenya. The purposive method was used as the criteria for choosing the two study locations. CLTS has been implemented in both counties by the government in protocols, and yet each one them has a social, economic and geographical difference, which calls for a comparison between the two, to ascertain, the outcomes of CLTs under these circumstances.

This study serves as a representative of all such areas with diverse socio-cultural and socio-economic diversity, in Kenya, Africa and globally. The study area in (Kilifi) is agricultural while the other (Marsabit) is nomadic, food deficient, and semi-arid. Both have different sanitation challenges and yet are expected to achieve ODF status in Kenya simultaneously by 2020 (Kenya ODF Roadmap, 2016) – under review.

### 3.5: Target Population

The targeted population were adult (18 and above) household heads. The study population was all households in Saku and Rabai Sub counties from Marsabit and Kilifi county report; totaling 371 villages (Rabai 177 villages and Saku 194 villages).

These two areas were selected purposively. This is because they both had a government CLTS project for one year from November 2020 to November 2021.

### 3.6: Sampling Procedure

#### 3.6.1 Sampling Technique

Purposive sampling was used to select the site of study. These are Saku and Rabai Sub Counties in Marsabit and Kilifi County.

The villages inside the sub counties were sampled using a multistage sampling technique, specifically a sort of cluster sampling where the population is divided into groups or clusters. Subsequently, a random selection was made of one or more clusters, and all individuals inside the selected cluster were included in the sample. The sampling method used was cluster sampling, specifically for selecting communities. The study employed a sample frame to choose households, and thereafter utilized simple random sampling to choose the households.

### 3.6.2 Sample Size Determination

The sample size was calculated using the standard Andrew Fisher method of 1998.

$$N = \frac{Z^2pq}{d^2}$$

Z=standard normal deviation 1.96

P=proportion of the estimate population

q=1-p (50%)

d=degree of accuracy set as 0.05

$$N= \frac{(1.96)^2(0.5)\ (0.5)}{(0.05)^2}$$

N= 384.2, equivalent to 385 participants per county

Desired total sample size for the two counties is:

N×2 = 770 participants.

The desired sample size was exceeded in the data collection phase, as a total of 811 residents participated in the study.

### 3.7: Inclusive Criteria

To participate in this study, the following criteria was used:

1. Heads of households

2. Age 18 and above years

3. Participants with more than 12 months living in the study area.

4. Those who consented to participate in the study

### 3.8: Exclusive Criteria

Participants were excluded from this study if they did not meet the above inclusion criteria.

1. Those were not heads of households

2. Under the age of 18 people

3. People who had not lived in the study area for at least twelve months

4. People who did not consent to participate in the study.

5. Household heads who were critically ill.

### 3.9: Construction of Research Instruments

The data collection utilized a widely recognized and verified questionnaire that has been employed in comparable investigations both domestically and globally. The questionnaire and data collecting procedure are a methodical and organized approach to acquiring information that is pertinent to the research purpose, specific objectives, questions, or hypotheses of a study (Grove et al., 2015).

### 3.10: Pilot Study

The pilot study was conducted to evaluate the lucidity, dependability, and relevance of the research instruments employed for data gathering. A pilot research was conducted in Kilifi County utilizing the specified instrument on 10 percent of the sample. Expert opinions were sought to validate the findings (Muhmmed et al., 2015). The findings of the pilot study aided the researcher in making essential adjustments to the tools, including the removal of unnecessary or redundant questions and the addition of missed questions.

### 3.11: Testing for Validity and Reliability of Research Instruments

#### 3.11.1 Testing for Validity

Grove et al. (2015) argue that researchers should evaluate the extent to which an instrument is valid, rather than simply determining whether it is valid or not, as no instrument can be completely valid. Validity, as defined by Polit and Beck (2017), pertains to the extent to which a questionnaire accurately assesses the topic under investigation. The researcher ensured the content validity of the questionnaire by generating items that aligned with the objectives of the study. The formula developed by Ebadi et al. in 2017 was employed to calculate the content validity index (CVI):

$$CVI = \frac{\text{Number of items rated as relevant (n)}}{\text{Total number of items in the questionnaire (N)}}$$

Where N represents the total number of items (questionnaires) and n represents the number of items declared valid in the questionnaire.

Adequate steps were made to make sure the instruments met content validity requirements. The researcher gave copies of the instrument to specialists, including the three supervisors and colleagues with greater experience, such as occupational health physicians, to have them score the valid items in the instruments in order to make sure they were collecting data as intended

$$CVI = \frac{\text{Number of items rated as relevant (n)}}{\text{Total number of items}}$$

$$CVI = \frac{\text{Number of items rated as relevant (n)}}{\text{Total number of items}}$$

The acquired CVI value, which serves as an indicator of the instrument's validity, was interpreted according to Cohen and Manion's (2018) scale. The study found a validity index of 0.75 or higher, above the standard value of 0.7. This indicates that the items used in the study were very relevant and acceptable.

### 3.11.2: Testing for Reliability Review this section

Reliability is the consistency with which an instrument measures a parameter it is intended to measure. Consequently, a pilot study was carried out before the device was employed in a place distinct from the actual region of study. According to the current study, the consistency of the tools in measuring the same phenomena can be referred to as reliability. For the current investigation, a reliability of 0.8, which was better than the lowest limit of 0.7, was deemed acceptable.

The pre-test results were then swapped out for the final results using the Pearson's Correlation Coefficient calculation. According to Cohen and Manion (2018), a trustworthy instrument should

return a value of 0.7. An average index of 0.7 or higher is required for the instrument to be considered valid and reliable (Wang et al., 2017). According to Cohen and Manion (2018), this number suggests that the complete questionnaire has a high degree of dependability. The result, 0.8, met expectations.

### 3.12: Data Analyses

The data analysis plan followed the quantitative aspects of the current study.

#### 3.12.1: The Quantitative Data Analysis Plan

In order to evaluate the data, IBM STATA was used. The prevalence was calculated using descriptive statistics, namely means, standard deviations, and percentage frequencies. To ascertain the adoption of CLTS and ODF in the two chosen locations, Sections A and B of the questionnaire were examined using the percentage frequency measure.

Propensity score matching (PSM) was used to estimate the impact of CLTS intervention on the sample population in the two counties. This technique was adopted to eliminate the effect of confounders. To estimate the average treatment effect, study participants in the two counties were matched based on propensity scores. The average treatment effect (ATT) was used to determine the impact that of CLTS intervention.

PSM is a quasi-experimental technique used by researchers to create an artificial control group. This is done by applying statistical methods to match each treatment group with a non-treated group that has similar features. By utilizing the results of the matching procedure, the researcher may accurately assess the effects of the intervention being studied. Propensity score matching (PSM) operates under the assumption that, by leveraging the observable attributes of the two

groups, the treated unit may be compared to the untreated unit as if the treatment had been randomized adequately. By employing this method, Propensity Score Matching (PSM) replicates the process of randomization and effectively addresses the biases that affect alternative non-experimental methods.

The steps to analyze data using PSM are as follows:

Initially, the data is distinguished, providing a clear distinction between the group that received treatment and the group that did not get treatment. Furthermore, the researcher calculates the propensity score using a discrete choice model such as logit or probit. In the second phase, the researcher verifies the presence of all pertinent factors. The variables refer to the initial qualities that are unaffected by the treatment. Subsequently, the researcher employs values anticipated by the logit or probit function to produce the propensity score. The third stage involves limiting the sample to a common range of values. This step guarantees that units with identical covariate values have a definite chance of being both treated and untreated. Subsequently, a suitable matching algorithm is selected and executed. Ultimately, the effect of the intervention on the matched sample is evaluated, and the standard errors are computed. The estimated impact of the intervention refers to the average discrepancy in results between the units that received treatment and their corresponding units that did not get treatment. This study employed the PSMATCH2 command in the IBM STATA software. The command runs all the aforementioned procedures, so effectively measuring the influence of CLTS on the state of sanitation.

Separate or distinct samples The t-test was employed to compare two groups of instances based on a single variable. A multivariate logistic analysis was used to determine the relationship

between the variables and covariates. A significance level of 0.05 was employed as the threshold for all tests conducted in this study. The study's conclusive results were presented in the form of visual representations such as graphs, charts, tables, and figures.

### 3.13 Ethical Consideration

To ensure that the research was conducted ethically, the researcher adhered to various required ethical considerations and authorities during data collection. These included the NACOSTI permit, approved study protocol, and the Marsabit and Kilifi County approval letters to ensure that all data collected would be handled as private and confidential.

The MKU Institutional Research Ethics and Review Committee (IREC) gave its approval for the study to proceed ethically. NACOSTI granted authorization for the research to be conducted, and the pertinent office of the County government granted permission for research to be conducted in a particular region. All participants gave their informed written consent after being asked to do so by the researcher. Prior to the collection of data, all participants received the necessary information regarding the study's significance and purpose before signing a consent form. Participants' privacy and confidentiality were respected. Rather than utilizing names in a questionnaire, each participant was given an identity number.

# CHAPTER FOUR: RESULTS AND DISCUSSION

## 4.1 Introduction

This chapter provides a summary of obtained results in tabular and figure formats. The chapter also consists a detailed analysis of the results obtained in the previous chapter. The analysis part is broken down into sections, each adopting and answering one of the objective questions identified in the first chapter of the report. The sections are; status of OD in Kilifi and Marsabit, level of awareness of CLTS in Kilifi and Marsabit, morbidity of diseases associated with sanitation in Kilifi and Marsabit, and factors influencing CLTS program performance.

**Table 4.1: Response Rate**

| | **Kilifi County** | **Marsabit County** |
|---|---|---|
| Females | 304 | 243 |
| Males | 107 | 157 |
| Total | 411 | 400 |
| Grand Total | 811 | |

In Kilifi County, 411 participants were targeted while in Marsabit County, 405 participants were targeted. The figures were slightly above the calculated target of 385 participants per county derived from the Andrew Fisher method to ensure that if the turn up falls below 100%, the desired target would still be met. Kilifi County had 100% response rate (N=411) while Marsabit County had 99% response rate (N=400). In total, the study recorded a turn up rate of N=811, slightly above the Andrew Fisher's desired target of 770. The response rate represents an excellent sample size that is neither too small nor too larger to impact study results.

### 4.2: Socio-Demographic Characteristics of Respondents

Table 4.2 displays the respondent's socioeconomic and demographic characteristics.

In both counties, the females represented a significant proportion; Kilifi 73.97% (N=304) and Marsabit 60.75% (N=243). In Kilifi County, 18.74% were above 61 years, and 23.84% of respondents aged between 31-40 years. In Marsabit, most study participants, 39.25% (N=157), were aged between 21-30 years. Regarding marital status in both counties, most were married; Kilifi (81.0%) and Marsabit (71.5%). Islam was the predominant religion in Marsabit (71.5%) and Christianity in Kilifi (69.76%). The monthly income earned by respondents varied across the two counties was also determined. In Kilifi County, 56.69% earned less than 5000 Kenya shillings per household per month. In Marsabit County, 21.5% earned between 5000-10,000 Kenya shillings per household per month. Regarding the level of Education, in Kilifi County, only 1.7% (n=7) had a university level of Education while in Marsabit, 3.25% (n=13) attained university education. The proportion of study participants who completed secondary school was higher in Marsabit (16.25%) than in Kilifi County (5.11%).

**Table 4.2 Socio-Demographic and Economic Characteristics**

| | **Kilifi** | **Marsabit** |
|---|---|---|
| **Gender** | **N(%)** | **N(%)** |
| Female | 304(73.97) | 243(60.75) |
| Male | 107(26.03) | 157(39.25) |
| Total | 411(100) | 400(100) |
| | **Kilifi** | **Marsabit** |

| **Marital Status** | **N(%)** | **N(%)** |
|---|---|---|
| Divorced | 16(3.9) | 12(3.0) |
| Married | 333(81) | 286(71.5) |
| Widowed | 38(9.3) | 33(8.3) |

| | **Kilifi** | **Marsabit** |
|---|---|---|
| **Religion** | **N(%)** | **N(%)** |
| Christian | 286(69.76) | 147(37.00) |
| Islam | 110(26.83) | 247(61.75) |
| Other | 14(3.41) | 5(1.25) |
| Total | 410(100) | 400(100) |

| | **Kilifi** | **Marsabit** |
|---|---|---|
| **Monthly Income** | **N (%)** | **N(%)** |
| 10,001-15,000 | 38(9.25) | 64(16.0) |
| 15,001-20,000 | 35(8.52) | 34(8.5) |
| 25001-30000 | 14(3.41) | 10(2.5) |
| 5001-10000 | 69(16.79) | 86(21.5) |
| above_30_000 | 3(0.73) | 22(5.5) |
| less_than_5,000 | 233(56.69) | 160(40) |
| Total | 411(100) | 400(100) |

| | **Kilifi** | **Marsabit** |
|---|---|---|
| **Education Level** | **N(%)** | **N(%)** |

| | | |
|---|---|---|
| College | 26(6.33) | 34(8.5) |
| primary complete | 129(31.39) | 47(11.75) |
| primary incomplete | 174(42.34) | 193(48.25) |
| secondary complete | 54(13.14) | 65(16.25) |
| secondary incomplete | 21(5.11) | 48(12.00) |
| University | 7(1.70) | 13(3.25) |
| Total | 411(100) | 400(100) |

| **Age Group** | **Kilifi N(%)** | **Marsabit N(%)** |
|---|---|---|
| 21-30 Years | 82(19.95) | 157(39.25) |
| 31-40 Years | 98(23.84) | 126(31.50) |
| 41-50 Years | 100(24.33) | 61(15.25) |
| 51-60 Years | 54(13.14) | 26(6.50) |
| Above 61 Years | 77(18.74) | 30(7.50) |
| Total | 411(100) | 400(100) |

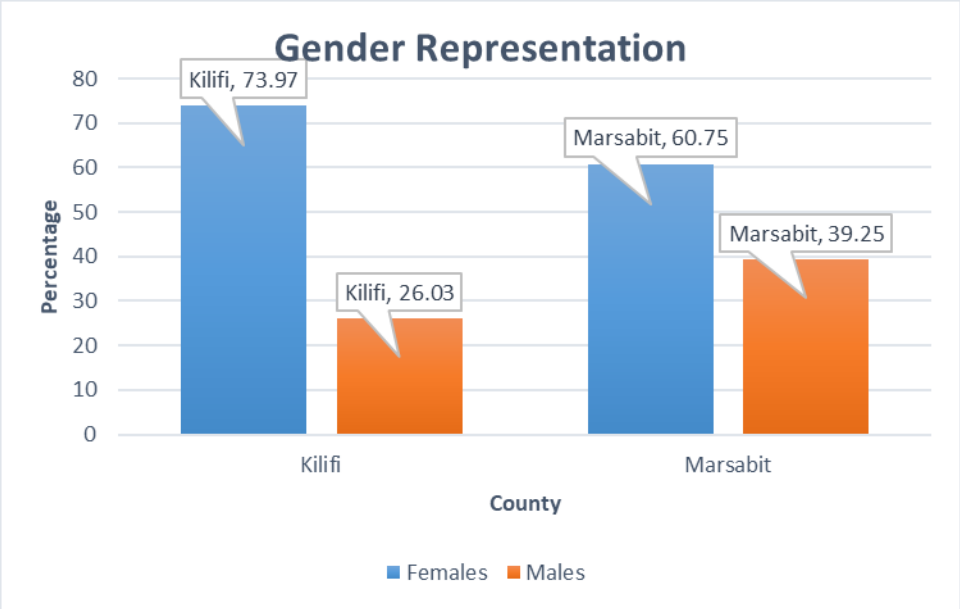


**Figure 4.1: Gender Representation**

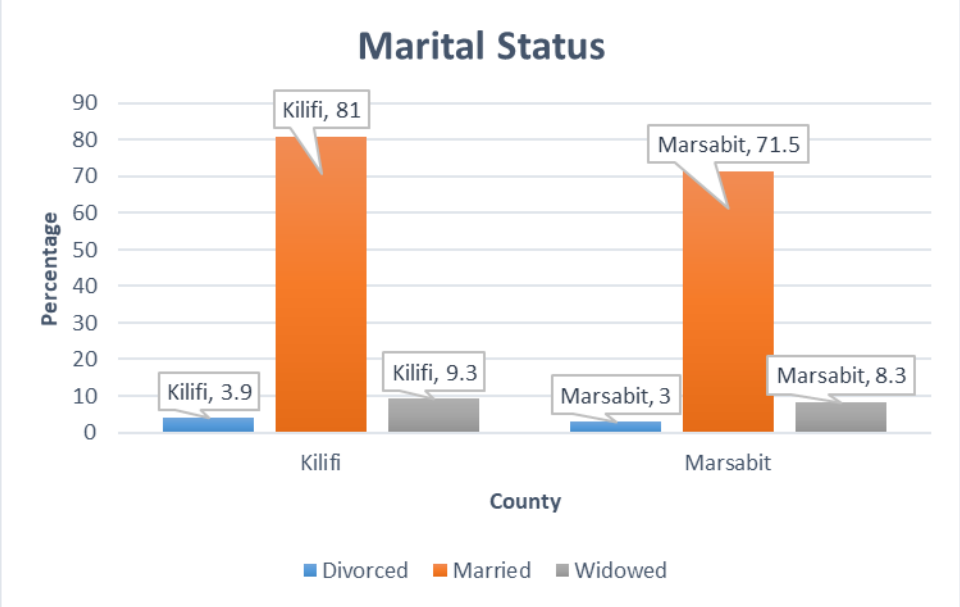


**Figure 4.2: Marital Status**

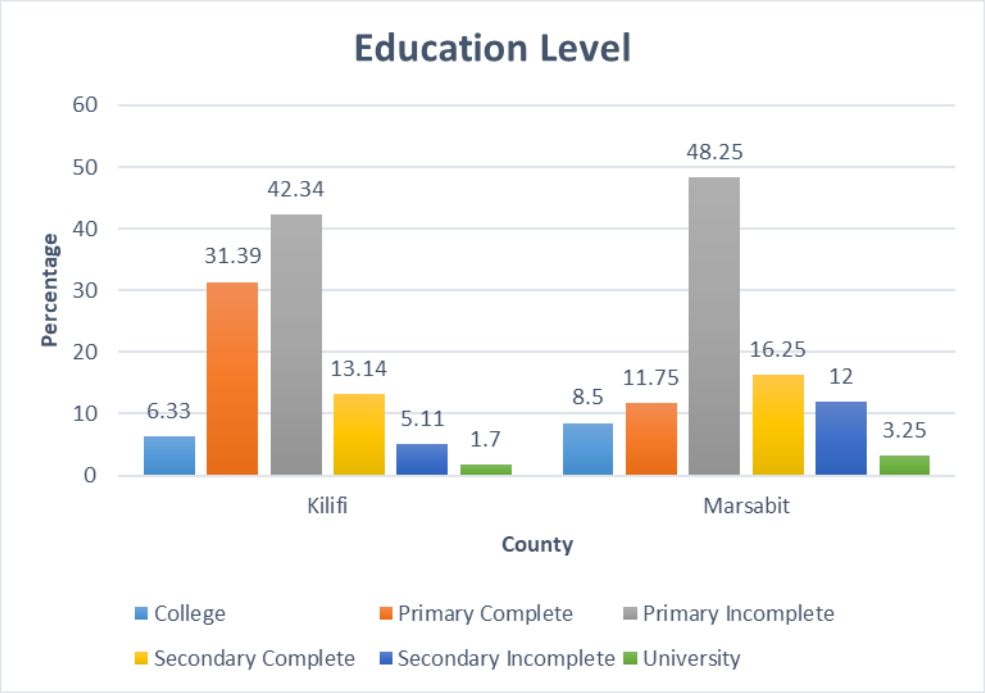


**Figure 4.3: Education Level**

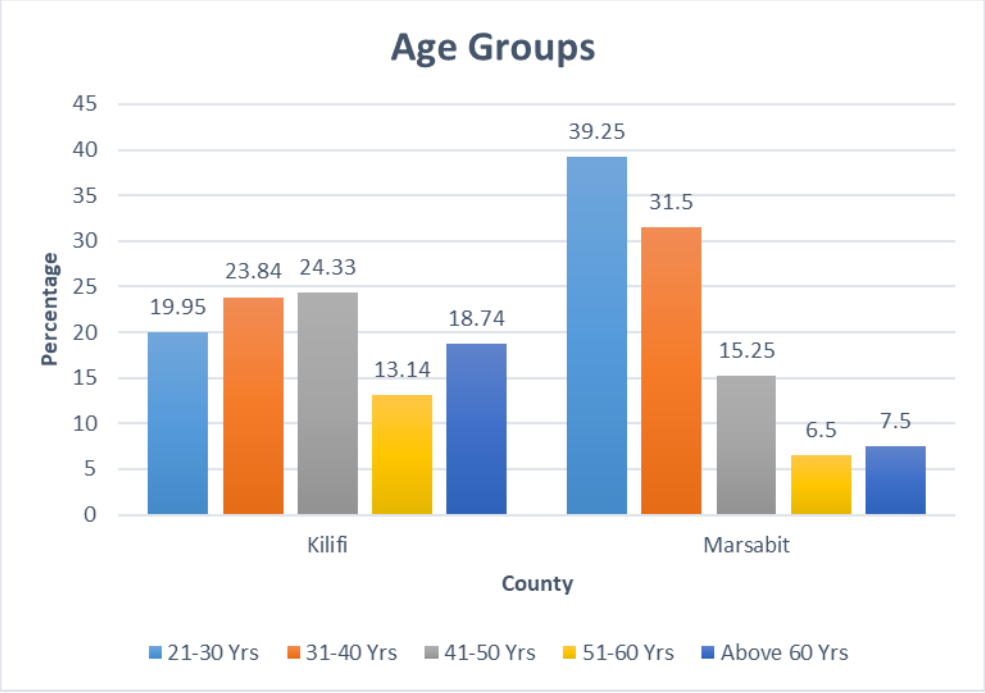


**Figure 4.4: Age Group**

### 4.3: Sanitation Use

Figures 4.5 and 4.6 illustrate the ODF statuses in Kilifi and Marsabit counties. In Kilifi County, 97.07% (N=398) of households had a sanitation facility, while 75.75% in Marsabit had a sanitation facility at their homestead and 24.25% (N=97) of households did not have.

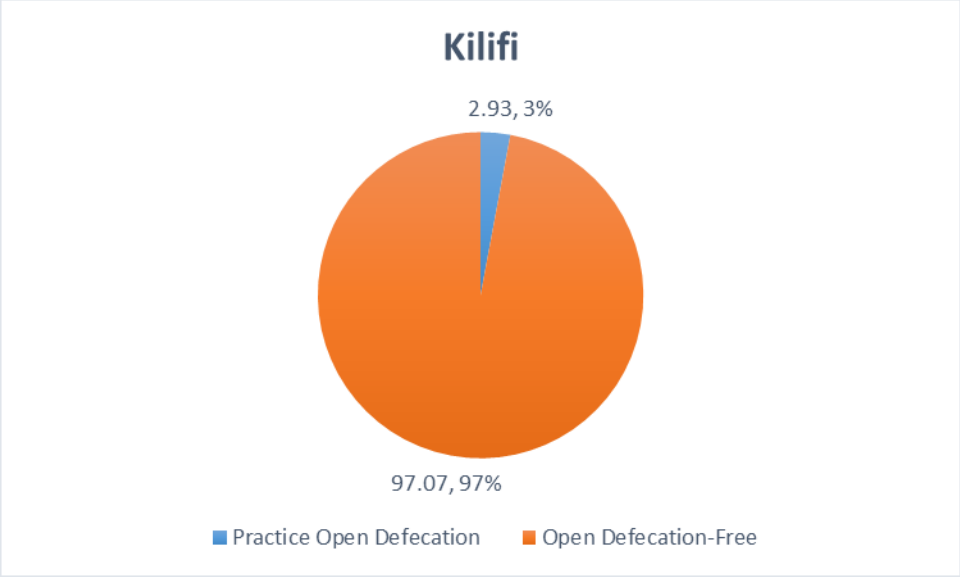


**Figure 4.5: ODF Status in Kilifi**

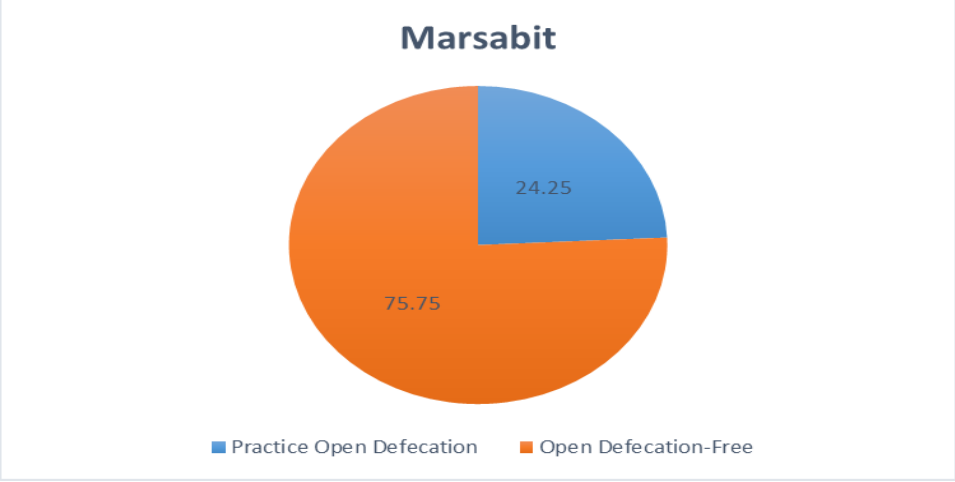


**Figure 4.6: ODF Status in Marsabit**

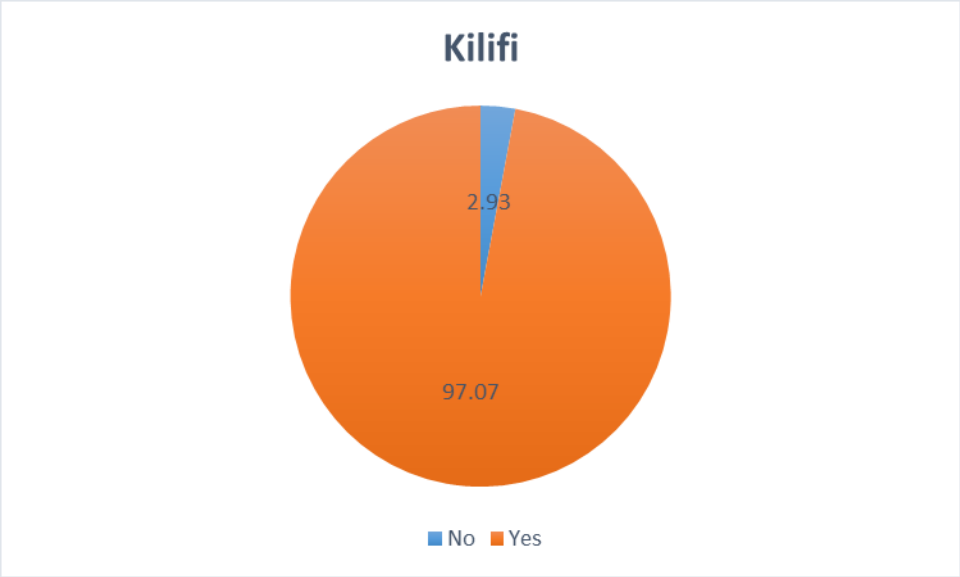


**Figure 4.7: Households with Sanitation Facilities in Kilifi**

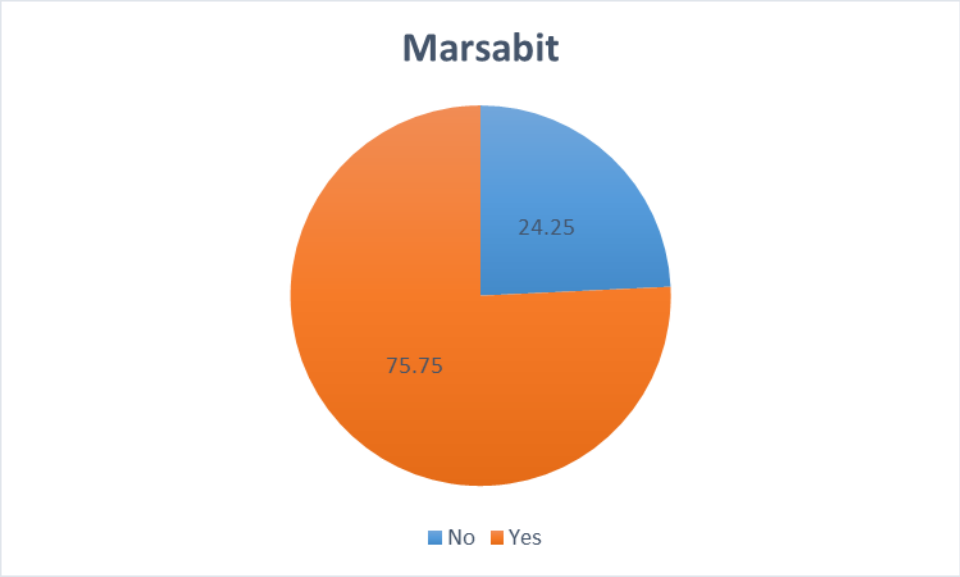


**Figure 4.8: Households with Sanitation Facilities in Marsabit**

### 4.3.1: Types of Sanitation Facilities

In households that reported having sanitation facilities, 64.69% (N=196) of Marsabit County households had an improved sanitation facility. In Kilifi County, 54.52% had an improved sanitation facility. The proportion of households with unimproved sanitation facilities in Kilifi (45.48%) was higher than those in Marsabit County. The high rate of unimproved sanitation facilities is explained by the two most critical factors; household income per month and level of education. In Kilifi County, participants had lower household income and level of education than in Marsabit County. For instance, 56% of Kilifi residents earn less than 5000 Kenyan shillings per household per month, compared to 40% in Marsabit, implying that most Marsabit residents earn more and can afford improved sanitation facilities than Kilifi residents. Regarding education levels, at least 40% of Marsabit residents have secondary level education or above, while in Kilifi County, only 26.28% have achieved same level of education. The higher literacy levels in Marsabit result in increased awareness about the adverse effects of poor sanitation, resulting in higher rates of improved facilities than in Kilifi County.

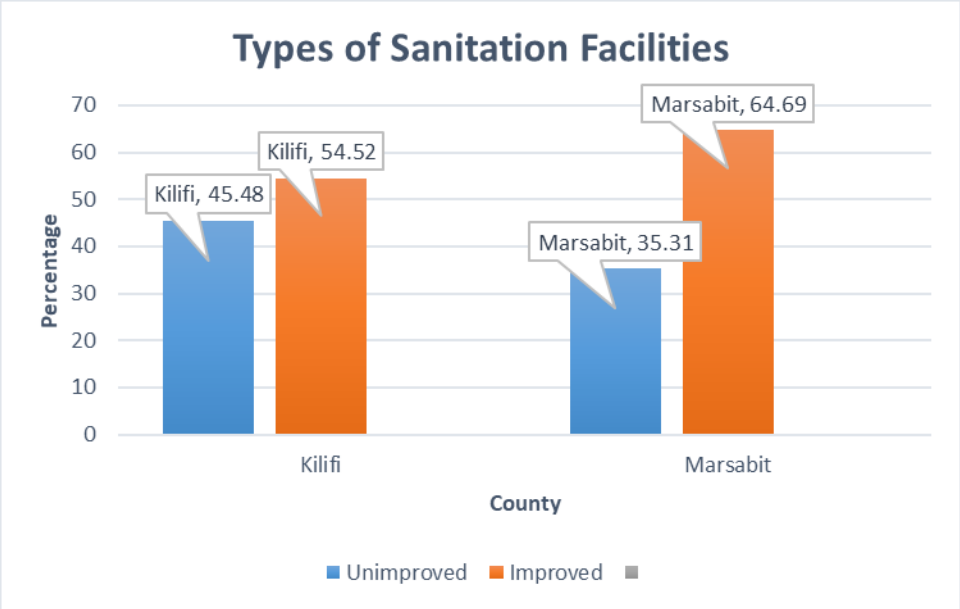


**Figure 4.9: Types of Sanitation Facilities in Kilifi and Marsabit**

### 4.4: Level of Awareness on CLTS

Figure 4.10 displays the overall level of CLTS in both Counties. Most study participants (87.67%) were fully aware of CLTS. Only 12.33% were not aware of CLTS.

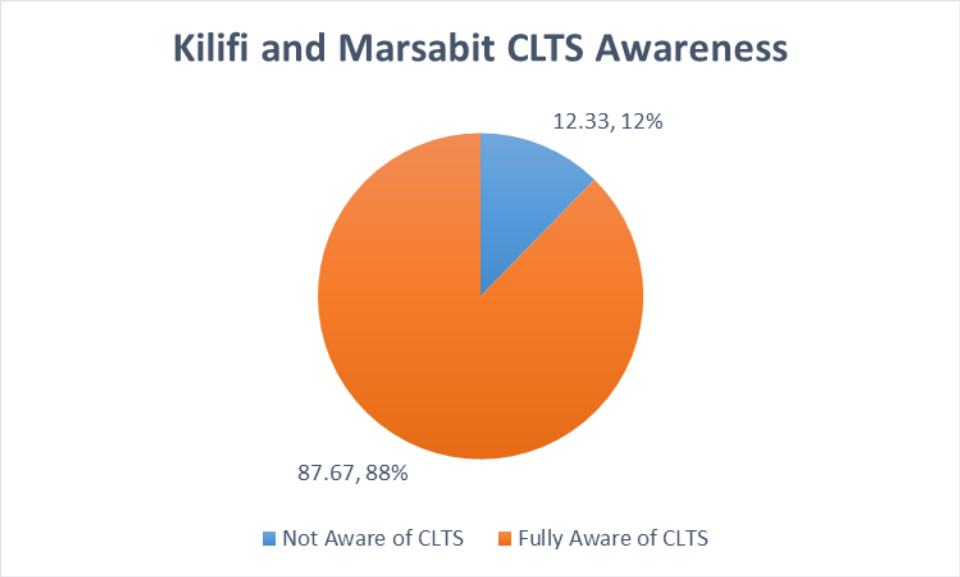


**Figure 4.10: Cumulative Level of CLTS Awareness in Kilifi and Marsabit**

**Level of Awareness on CLTS by Counties**

The proportion of study participants unaware of CLTS was higher in Marsabit, 23%, compared to those in Kilifi. Among those fully conversant with CLTS, 98% resided in Kilifi County; 77% in Marsabit were fully aware of CLTS, as illustrated in Figure 4.11.

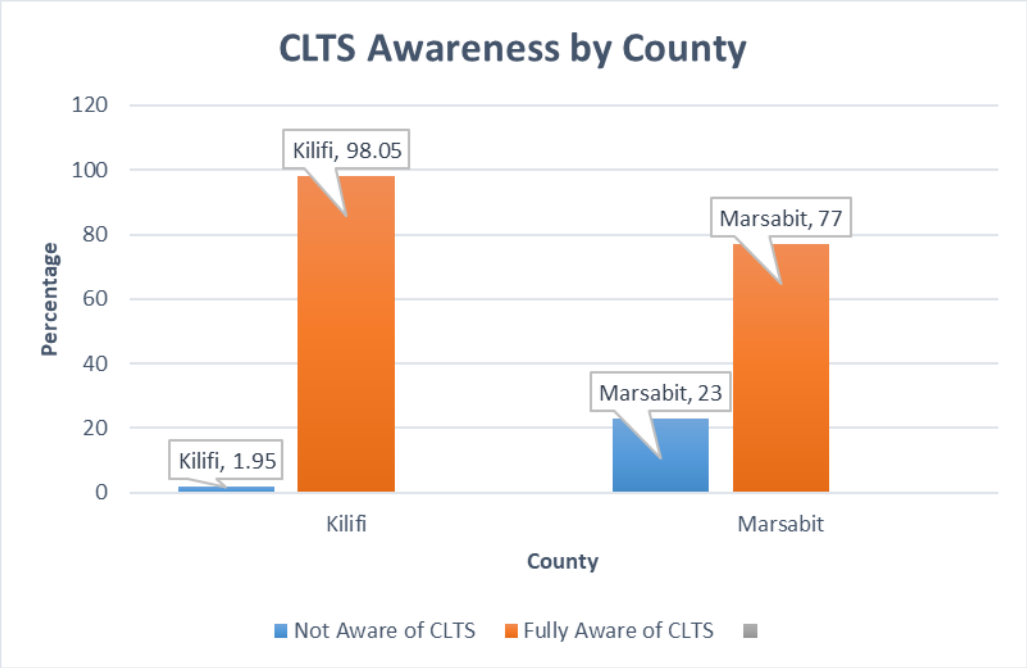


**Figure 4.11: CLTS Awareness by County**

### 4.5: Factors influencing the CLTS among Kilifi and Marsabit Counties communities in Kenya

Table 4.3 illustrates the covariates influencing CLTS among communities in Kilifi and Marsabit counties in Kenya. Logistic regression analysis findings show that the probability of owning a sanitation facility was associated with age. The households with household heads aged 41-50 were twice as likely to own a sanitation facility than those with a household head aged 21-30 (A.O.R=2.41, *p=0.03*). Also, households with a household head aged above 61 years were four times more likely to own a sanitation facility (A.O.R=4.046, *p=0.009*).

A statistically significant association existed between having a college-level education and owning a sanitation facility. Adjusted odds show that households with college-educated household heads were ten-fold likely to own a sanitation facility at homesteads (A.O.R=10.273, *p=0.013*).

Regarding gender, households having male study participants as the head of the household were 0.5 times more likely to own a sanitation facility (A.O.R=0.558, *p=0.03.* Further, handwashing awareness was statistically associated with owning a sanitation facility. Households with household heads having good handwashing awareness were twice as likely to own a homestead sanitation facility (A.O.R=2.459, *p=0.002*) than those whose household heads had poor handwashing awareness. Concerning CLTS awareness, household heads who were aware of CLTS were statistically associated with owning a sanitation facility (A.O.R=4.317, *p=0.022*).

**Table 4.3: Logistic Regression Analysis**

| Variables | A.O.R | *p-value* | [95% Co Lower | Interval] Upper | Sig |
|---|---|---|---|---|---|
| **Age Groups** | | | | | |
| 21-30 years | Base | | | | |
| 31-40 years | 1.631 | *0.148* | 0.841 | 3.162 | |
| 41-50 years | 2.41 | ***0.03*** | 1.091 | 5.326 | ** |
| 51-60 years | 1.70 | *0.277* | 0.654 | 4.419 | |
| 61> years | 4.046 | ***0.009*** | 1.417 | 11.553 | *** |
| **Marital Status** | | | | | |
| Divorced | 1 | | | | |
| Married | 0.982 | *0.98* | 0.244 | 3.957 | |
| Single | 0.906 | *0.901* | 0.193 | 4.265 | |
| Widowed | 0.445 | *0.321* | 0.09 | 2.202 | |

| | | | | | |
|---|---|---|---|---|---|
| **level of Education** | | | | | |
| Primary incomplete | 1 | | | | |
| Primary complete | 2.013 | *0.305* | 0.529 | 7.663 | |
| Secondary incomplete | 0.649 | *0.489* | 0.19 | 2.209 | |
| Secondary complete | 1.919 | *0.340* | 0.503 | 7.328 | |
| College | 10.273 | ***0.013*** | 1.637 | 64.478 | ** |
| University | 0.49 | *0.545* | 0.049 | 4.947 | |
| **Monthly Income** | | | | | |
| 5000-10000 | 1 | | | | |
| 10,001-15,000 | 6.461 | *0.091* | 0.742 | 56.262 | * |
| 15,001-20,000 | 1.609 | *0.578* | 0.301 | 8.607 | |
| 20,001-25,000 | 0.416 | ***0.052*** | 0.172 | 1.007 | * |
| >30,000 | 0.458 | *0.060* | 0.203 | 1.033 | * |
| **Duration lived in the homestead** | 1.008 | 0.234 | 0.995 | 1.022 | |
| **Gender** | | | | | |
| Female | 1 | | | | |
| Male | 0.558 | ***0.034*** | 0.326 | 0.956 | ** |
| **Handwashing Awareness** | | | | | |
| Poor | 1 | | | | |
| Good | 2.459 | ***0.002*** | 1.381 | 4.378 | *** |
| **CLTS Awareness** | | | | | |
| not aware | 1 | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Fully aware | 4.317 | ***0.022*** | 1.24 | 15.028 | ** |
| **Climatic Conditions** | | | | | |
| Extreme hot and dry | 1 | | | | |
| Moderately rainy | 5.785 | ***0.038*** | 2.821 | 11.864 | *** |
| **Constant** | 1.889 | 0.531 | 0.259 | 13.791 | |
| Mean dependent var | 0.858 | | | SD dependent var | 0.349 |
| Pseudo r-squared | 0.2552 | | | Number of obs | 760 |
| Chi-square | 158.544 | | | Prob > chi2 | 0 |
| Akaike crit. (AIC) | 506.781 | | | Bayesian crit. (B.I.C.) | 608.714 |

Notes: *** p<.01, ** p<.05, * p<.1

### 4.6 Impact of CLTS Intervention on Sanitation Status

The results under this sections demonstrates the impact of CLTS intervention programs on sanitation levels in Kilifi and Marsabit counties. Sanitation levels were determined by the communities' ownership of sanitation facilities, which also impacts OD status and morbidity of diseases associated with poor sanitation levels. In addition, the results under this section assessed CLTS awareness levels and, after that, determined the major factors influencing the impact of CLTS on communities' sanitation status. Propensity score match (PSM) analysis was used to evaluate the impact of CLTS intervention on sanitation status in Kilifi and Marsabit Counties. This technique was adopted to eliminate the effect of confounders. To estimate the average treatment effect, study participants in the two counties were matched based on propensity scores. The average treatment effect (ATT) was used to determine the impact of CLTS intervention. Effects

of covariates, such as education level, income, CLTS awareness, and handwashing awareness on sanitation status was also determined.

Table 4.4 illustrates that the average treatment effect (ATT) difference was 0.0344. This implies that the intervention resulted in a 42% increase in households owning a sanitation facility. By confirming the positive impact that CLTS programs have on ownership of sanitation facilities, the PSM analysis demonstrates that CLTS programs impact sanitations status in Kilifi and Marsabit significantly. However, the analysis showed lack of statistical significance (t=0.42, *p=0.0835*), implying that the possibility of the occurrence being out of chance was more.

**Table 4.4: Propensity Score Matching**

| **Variable** | **Sample** | **Treated** | **Controls** | **Difference** | **S.E.** | **T-stat** | **p-value** |
|---|---|---|---|---|---|---|---|
| Type of Sanitation | Matched | 0.4496 | 0.5242 | -0.0746 | 0.0362 | 2.06 | *p=0.0835* |
| | ATT | 0.4699 | 0.4355 | 0.0344 | 0.0813 | 0.42 | |

Post-hoc propensity scores analysis illustrated in Table 4.5 shows that the ownership of a sanitation facility was influenced by CLTS awareness (*t= -2.51, p=0.012*), education level (t= 4.16, p=*0.0001),* monthly household income (*t= -10.76, p=0.0001*). The results confirm that these covariates (education, CLTS awareness, handwashing awareness, and education level) impacted ownership of sanitation facilities, thus influenced ownership of sanitation facilities.

**Table 4.5: Effect of Covariates on Sanitation Facility Ownership**

| | Means | | | t-test | |
|---|---|---|---|---|---|
| **Variables** | **Treated** | **Control** | **% Bias** | **t-value** | **p>t** |
| Monthly Household income | 4.6447 | 6.2808 | -72.1 | -10.76 | *0.0001* |
| CLTS awareness | 0.79083 | 0.86246 | -22.7 | -2.51 | *0.012* |
| Hand wash awareness | 0.09456 | 0.09456 | 0 | 0 | *1.000* |
| Education level | 4.2464 | 3.9542 | 28.6 | 4.16 | *0.0001* |

To sum up, the PSM analysis demonstrates the positive correlation between CLTS programs and ownership of sanitation facilities. The correlation implies that the programs have effectively resulted in more households within Kilifi and Marsabit owning sanitation facilities, thus moving away from OD. As such, the results answer the current hypothesis on the effectiveness of CLTS by confirming that these programs are effective in improving sanitation levels within communities. However, the results also confirm that CLTS programs are not independently effective but are impacted by other factors, such as education levels, awareness, and household income.

### 4.7: Morbidity of Diarrhea in Kilifi and Marsabit Counties

In order to understand the impact of poor sanitation and health risks associated with poor sanitation, data from Rabai and Saku Sub-County Hospitals and the MoH on morbidity of diarrheal diseases in Kilifi and Marsabit Countries were examined during the 12-month CLTS implementation period.

Table 4.6 shows raw data and summary analysis of morbidity of diarrheal diseases in Kilifi and Marsabit Counties over the 12-month period.

**Table 4.6: Morbidity Statistics of Reported Diarrhea Disease in Kilifi and Marsabit Counties Over the 12-Month CLTS Implementation Period**

| Period | Total Diarrheal Cases in Kilifi | Total Diarrheal Cases in Marsabit |
|---|---|---|
| **START**<br>**Dec-20** | 474 | 484 |
| **Jan-21** | 272 | 712 |
| **Feb-21** | 260 | 859 |
| **Mar-21** | 932 | 883 |
| **Apr-21** | 610 | 535 |
| **May-21** | 952 | 521 |
| **Jun-21** | 719 | 563 |
| **Jul-21** | 1282 | 492 |
| **Aug-21** | 1678 | 428 |
| **Sep-21** | 1366 | 478 |
| **Oct-21** | 1278 | 344 |
| **Nov-21** | 1407 | 425 |
| **END**<br>**Dec-21** | 1356 | 351 |
| **Mean** | 968 | 544 |
| **4-Month Mean at Start of CLTS Implementation** | 484 | 734 |

| | | |
|---|---|---|
| **4-Month Mean at the End of CLTS Implementation** | 1351 | 399 |
| **t-Test: Paired Two Sample for Means** | | |
| | | |
| | ***Kilifi*** | ***Marsabit*** |
| **Mean** | 968.1538 | 544.2308 |
| **Variance** | 218491.5 | 29905.53 |
| **Observations** | 13 | 13 |
| **Pearson Correlation** | -0.65745 | |
| **Hypothesized Mean Difference** | 0 | |
| **Df** | 12 | |
| **t Stat** | 2.566473 | |
| **P(T<=t) one-tail** | 0.012353 | |
| **t Critical one-tail** | 1.782288 | |
| **P(T<=t) two-tail** | **0.024705** | |
| **t Critical two-tail** | 2.178813 | |

Kilifi County and Marsabit County recorded mean diarrheal cases of 968 and 544, respectively, during the 12-month CLTS implementation period. In Kilifi, the 4-month average diarrheal cases at the start of the implementation period was 484, lower than the 4-month average at the end of the implementation period, recorded at 1351. However, in Marsabit, diarrheal cases significantly reduced from a 4-month average of 734 to an average of 399 cases at the end of the implementation period.

A student t-test was utilized to test the hypothesis that the mean difference in reported diarrheal diseases under the implementation period (November 2020 to November 2021) was zero. The difference in diarrheal morbidity at the start and at the end of the 12-month implementation period for the two counties was statistically significant (*t= 2.56, p=0.024*). The statistical significance

implies that CLTS programs implemented in the 12-month period significantly impacted the number of diarrheal and dysentery cases in both Kilifi and Marsabit counties.

## 4.7 Discussion

### 4.7.1 Status of Open Defection in Kilifi and Marsabit

The two counties under the current study reported varied levels of ownership/access to sanitation facilities, demonstrating county disparities in the country. Kilifi County recorded a 97.07 percent ownership rate, which was significantly above the 75.75 percent reported in Marsabit. The data implies that about 2.93 percent of Kilifi residents did not own a sanitation facility, while 24.25 percent of Marsabit residents reporting the same. On average, about 13.45 percent of residents in the two counties did not own or access a sanitation facility. In the review section, the Water and Sanitation Report (2012) indicated that about 31 percent of the Kenyan population in urban setups have access to improved sanitation, while the rural population had a slightly lower access at 30 percent. Also, the report indicated that about 72 percent of the rural population that had access to sanitation facilities owned simple pit latrines with varied degrees of privacy, safety, and hygiene, thus faced related health risks. The results of the current study are in line with the latest MoH Report (2018) showing access levels of over 70 percent but with a significant majority of these facilities being unimproved and posing health risks to residents.

Despite a high number of residents reporting access to only unimproved sanitation facilities, the rate of access to improved facilities has compared to the status reported by the Water and Sanitation Program in 2012. In 2012, slightly over 70 percent of Kenyans did not access improved facilities. However, in the current study, the percentage of respondents inaccessible to improved facilities dropped significantly to about 36 percent and 46 percent in Marsabit and Kilifi, respectively. This shows that there has been a significant growth in the number of improved facilities in Kenya's

rural areas. The growth was impacted by multiple socio economic and demographic factors discussed in detail, later in this chapter.

The two-county average of lack of access to sanitation facility (13.45 percent) is almost equal to the country's open defection rate (14 percent) reported by the MoH report (2018). However, the OD average was significantly lower than other counties in the region, such as the 77% OD rate in Laisamis, 75% in North Horr, and 515 in Moyale (UNICEF& USAID Report, 2016). This implies that the approximately 30 million Kenyans reported by the Water and Sanitation Program to be using unsafe sanitation methods are still at risk. According to the MoH report of 2018, Kenya has been shifting its goals regarding its ODF program. In the initial road map, rural villages were targeted and an ODF environment was assigned a 2013 deadline, which was not achieved (MOH Report, 2018). Later, the government shifted its goals, setting a 2020 deadline as the new ODF target. Considering that the two counties in the current study, Kilifi and Marsabit, have a 13.45 percent open defection rate reported in the current study, it shows that the 2020 deadline was also missed. The missed deadline implies that the ministry must rethink its road map and implementation strategies if the next deadline is expected to be achieved. In addition to changing tact, the ministry must ensure that the ODF rural program is rolled out countrywide for better results. After the initiation of the program in 2013, the WHO Report (2015) showed that only 15 percent of the targeted areas had triggered the program. The inability of over 85 percent of the targeted villages to roll out the program implies that these villagers persisted with open defection behaviors, derailing the gains made by the program. Lastly, the evaluation of the program was ineffective because success rates as reported by the WHO and the MoH did not tally. The differences show that the evaluation process of the ODF program is not standardized, thus

potentially signaling false positive results for the Kenyan government. In the future, the evaluation process must be standardized to ensure accuracy in reporting, which will result in proper planning and implementation of the next programs.

To sum up, the current study answered the question about the current status of OD and ODF status in the counties under study by reporting 2.93 percent and 24.45 percent OD rates for Kilifi and Marsabit, respectively. On average, the two counties reported a 13.5 percent open defection rate, slightly lower than the 14 percent country average reported by the Water and Sanitation Program in 2012. Despite the high rates, the current study established that open defection in the two counties reduced significantly from 64 to 24.45 percent for Marsabit and 34 percent to 2.93 percent for Kilifi (WSP, 2012; MoH Report, 2018). The drop could be attributed to increased varied socio, economical, and demographic factors that impact CLTS performance. These factors will be discussed later in this chapter.

### 4.7.2 Level of Awareness of CLTS in Kilifi and Marsabit

CLTS awareness levels varied significantly between the two counties. In Marsabit, unawareness level was recorded at about 23 percent, higher than the 2 percent rate recorded in Kilifi. Averagely, the two counties reported 87.6 percent awareness and 12.3 percent unawareness levels. Considering that OD rates in Marsabit and Kilifi were about 24 percent and 2.9 percent, respectively, it shows that lack of CLTS awareness is associated with open defection practices in the two counties. In Kilifi, a 2 percent unawareness rate resulted in 2.9 percent OD rate while in Marsabit, a 23 percent unawareness resulted in 24 percent open defection rates. In both countries, the unawareness rate was almost equal, but slightly lower than the open defection rate, confirming that persons who were not aware of the CLTS programs were highly likely to practice OD. Only

about 1 percent of the population practiced open defection with total awareness of CLTS programs. The findings confirm that CLTS awareness is an effective approach in the fight towards achieving ODF status in rural communities. The MoH and interested stakeholders must invest in CLTS awareness when rolling out such programs to increase efficiency and achieve program goals. Targeting to increase awareness levels in a bid to achieve ODF communities has shown to be effective in different communities, as reported in the review. For example, a study was conducted in Mali to establish the impact of CLTS awareness on access and use of latrines. In villages where access and use of latrines was at 33 percent before CLTS awareness, the rate increased to 65 percent post-intervention phase. Besides access and use, full ownership of latrines increased significantly, by about 39 percent, thus reducing open defection practices in the region (Pickering, 2015). In a similar study, Garn (2017) found that CLTS awareness increases latrine coverage by 6-12 percent, and the increase reach 30 percent if proper awareness campaigns are performed. These results show that for Kenya to achieve its ODF targets and increase ownership, access, and use of sanitary facilities, the interested stakeholders must target increased CLTS awareness levels for improved outcomes.

### 4.7.3 CLTS Program Covariates

**Age**

Increase in age was associated with increased awareness and practice of CLTS program measures. As reported in the result section, the current study incoporated participants of ages 21 to 61 years and bove. For better analysis, the current study divided the age range in tens for a more accurate analysis of how it impacts CLTS program. The study found that participants aged 41-50 were twice as likely to own a sanitation facility and practice CLTS measures than those aged 21-30 years.

Comparing the 21-30 age group and the above-61 age group showed that the elder group was four times more likely to own sanitation facilities and practice proper sanitation practices than the younger participants. Considerig that the younger generation in the two counties was more educated than the older generation, ignorance and illiteracy are not causative to poor CLTS practice in the younger generation. On the contrary, the poor status in the young generation was primarily contributed by socio-economic status. Particpants in the 21-30 age group were unlikely to own a sanitation facility and unlikely to implement CLTS practices because they lacked funds and resources to access and impelemnt such mesures. On the contrary, those above 61 years have access to resources and funds achieved through years of accumulated wealth. The access to more resources and funds enabled the elderly to own sanitary acilities and practice CLTS measures that promote proper sanitation.

The correlation between age of a household head with sanitation practices was also confirmed by Belay et al. (2022). According to Belay et al., Ethiopia's OD rate dropped significantly from 81.96% in 2000 to 32.23% in 2016. After a study to determine covariates facors that contribuyed to the drop, the researchers found that OD was substantially correlated with individual and community-level characteristics including age (Belay et al., 2022).

**Education**

The study found a statistical significant association between education and owning a sanitary facility in Kilifi and Marsabit. According to this study's results, households with household heads having college education were ten times more likely to own a sanitation facility than those with household heads who droped out at primary school level. However, the statistics were not signififcant when college graduates were compared with university graduates, implying that

college level education was the peak at which literacy levels influenced ownership of sanitation facilities and practice of CLTS measures. Further eduation beyond college did not have significant impact on ownership rate because such individuals had already acquired the relevant and necessary knowledge. The correlation beween education and sanitation is due to the understanding and knowlegde that residents acquire, regarding effects of poor sanitation in the community. An educated person is likely to understand the correlation between poor sanitation and its related dseases, making them adhere to proper sanitation practices to avert the health issues. However, less educated persons rely on unfounded myth, regarding sanitation-related diseases, which results in disregard to sanitation measures. The associaton between education and sanitation suggest that CLTS implementation strategies should target enjoining efforts with curiculum developers to incoporate awareness efforts in learners curricular. The implementation of such strategies will shift the peak level from college education to primary-level education, resulting in increased awareness since the majority of reaidents in Kilifi and Marsabit are either primary-school leavers or dropouts.

In the review, multiple studies found a positive correlation between literacy and improved sanitation practices. Seidu et al. (2021) studied how women dispose children's feces. The study found that sanitation initiatives in Sub-Saharan Africa (SSA) tended to prioritize home sanitation over the significance of properly discarding children's feces. The study sought to uncover the personal and environmental factors that influence how women in 15 SSA nations safely dispose of their children's waste. The results showed that, with considerable regional differences, 58.73% of women in the 15 SSA nations safely disposed of their children's feces. The percentage of safe disposal was highest in Rwanda (85.90%) and lowest in Chad (26.38%). The practice was influenced by several personal and environmental circumstances. According to the study,

newborns under one had a higher chance of being safely disposed of than those under one. The study also discovered that children with diarrhea were more likely to be safely disposed of than children without diarrhea. Mothers with only a primary education were less likely to conduct safe disposal than mothers with a higher level of education (Seidu et al., 2021).

Similarly, Njuguna (2019) found a correlation between higher education and proper disposal of fecal waste. The researcher conducted three nationwide household surveys in 2003, 2008, and 2014. To investigate the link between several variables and the presence of OD, he employed descriptive analysis and bivariate logistic regression. OD was the dependent variable, and the independent factors were gender, household head's educational degree, place of residence, region, and lack of farm animals. Among the most important predictors of OD, according to the study, was the educational degree of the household head (Njuguna, 2019).

**Gender**

Regarding gender, households having male study participants as the head of the household were 0.5 times more likely to own a sanitation facility. The difference in gender conformities is due to the assigned gender roles in the studied communities. In the two counties, women take up the bulk of roles related to sanitation. They are responsible for fetching water, washing, and sourcing for sanitation facilities in homes. Despite women not making the majority of household heads, they make most decisions related to sanitation and hygiene. The critical roles that women play in sanitation measures make them more likely to own and practice proper sanitation because they have fast-hand experience on the adverse effects of sanitation. Also, women have a bigger role in taking care of under-fives, compared to men. Since under-fives are disproportionally affected by sanitation-related diseases, women are at the forefront to ensure that they practice proper sanitation

measures to protect their children from contracting sanitation-related diseases. To change this trend, men have to take up more roles related to sanitation to increase their CLTS awareness and interest in proper sanitation practices.

The probability that female household heads in Kilifi and Marsabit were more likely to implement sanitation measures in a household than male household heads contradicted results reported by Wamera (2012) in her study conducted in the Western region of Kenya. According to Wamera (2012), men in Western region were mostly the decision makers in matters related to the construction and funding of sanitation facilities. As such, households with male heads were more likely to own a sanitation facility than those with a female household head. The results show how different cultures assign gender roles and how such roles impact sanitation status. In addition, Kasiya (2022) confirms the impact of culture on sanitation practices, in a study that aimed to determine how gender duties impact implementation of sanitation measures. The study found that several gender duties, such carrying water, gathering firewood, and caring for livestock in rural places, encouraged OD. Therefore, genders that were assigned these roles were more likely to condone open defection when they assumed household leadership roles than genders that did not participate in such activities.

**Income**

Similar to education, the study found statistically significant association between income and owning sanitation facilities. Participants who earned between 10,000-15,000 Kenya Shillings were six times more likely to own a sanitary facility than those who earned between 5,000-10,000 Kenya Shillings. However, comparing higher income earners, from 15,000 to above 30,000 showed no significant statistical difference. Therefore, the income and education factors complement in the way they impact ownership of sanitation facilities and practice of CLTS measures. Low income earners do not own sanitation facilities nor practice sanitation measures due to affordability issues. However, further increase in income, above the peak performance wage (10,000-15,000) did not increase facility-ownership rate. The results show that funding of sanitation programs in Kilifi and Marsabit is critical to attaining high facility-ownership and sanitation adherence rates. Most conformers fail to adopt to CLTS measures because they lack resources and funds to enable them own or access proper sanitation measures.

Multiple studies in the review found a relationship between poverty/low total household income with OD. Belay et al. (2022) examined the prevalence and causes of OD among families in sub-Saharan Africa (SSA). The authors noted that OD makes it easier for diarrheal infections to spread and puts girls and women at risk of sexual exploitation. A total of 452,281 households from 33 SSA nations were included in the study's analysis. With significant differences between nations, the pooled prevalence of OD practice in SSA was found to be 22.55%. There were community-level characteristics like residence, country income status, and area as well as individual-level ones like age, education, media exposure, economic status, and availability to drinking water that were

linked to the practice of OD. OD was disproportionately concentrated in poor households, according to the concentration index (pro-poor distribution) (Belay et al., 2022).

An additional study by Belay et al. (2022) investigated the spatiotemporal distribution and factors that influence OD among Ethiopian households. The authors examined the prevalence, spatial distribution, and causes of OD among Ethiopian households. Using a weighted sample of 16,554 households and data from the 2016 Ethiopian Demographic and Health Survey (EDHS), the researchers conducted a secondary data analysis. They used mixed-effect analysis to analyse the trends in OD over a 16-year period. According to Belay et al. (2022), OD in Ethiopia was substantially correlated with individual and community-level characteristics including poverty/economic status. The study found that households with low incomes are disproportionately affected by OD, demonstrating wealth-related inequities.

**Marital Status**

The study did not find statistical significant association between facility ownership rates among the divorced, married, and single participants. The lack of significant difference between different marital status shows that other factors, such as education levels and income, had more weight in determining sanitation facility ownership than social status. Therefore, regardless of the relationship status of an individual, there were only likely to own sanitation facilities if other relevant factors (education and income) were confirmed.

Regarding the reviewed studies, there is scarcity of literature on the relationship between marital status and open defection. There was no study reporting whether has any correlation between marital status with whether a person owns or does not own a sanitation facility.

**Handwashing and CLTS Awareness**

The study determined that handwashing awareness and CLTs awareness were statistically associated with owning a sanitation facility. Participants who showed awareness of the benefits of washing hands with adequate water and soap were twice as likely to own sanitation facilities because they understood the risks and dangers of no adhering to sanitation measures. Similarly, participants who were fully area of CLTS programs were four time more likely to own sanitation facilities than those who were not aware of the programs. The awareness factor and level of education are correlated, because high awareness level is associated with high level of education among residents. As outlined in the previous sections in this chapter, ODF programs must invest in awareness levels among public and learners to ensure that rural residents are aware of CLTS programs and the adverse effects of improper sanitation practices.

Seidu et al. (2021) also confirmed the statistical association between handwashing and CLTS awareness with owning a sanitation facility. Seidu et al. used secondary data from the Demographic and Health Surveys (DHS), which included 128,096 mother-child pairs with children under the age of five and were conducted between 2015 and 2018. The safe disposal of children's stools was examined using multilevel logistic analysis. The results showed that, with considerable regional differences, 58.73% of women in the 15 SSA nations safely disposed of their children's feces. Safe disposal was influenced by several personal and environmental circumstances, including exposure to mainstream media that promoted their handwashing awareness.

### 4.7.4 Morbidity of Diseases Associated with Sanitation in Kilifi and Marsabit

The current study, after utilizing a student t-test to test the null hypothesis, established that the mean difference in diarrhea morbidity in Kilifi and Marsabit during the CLTS implementation period was statistically significant. The statistical significance implies that the mean cases of diarrhea reported in Marsabit (266 cases) and Kilifi (469 cases) were real, reliable and not due to chance. Therefore, the t-test results correlate the significant drop in OD from 64 to 24.45 percent for Marsabit and 34 percent to 2.93 percent for Kilifi, to the significant decrease in the number persons coming into contact with fecal matter or consuming contaminated water. Due to the reduced risk of contamination and contact, the number of diarrhea cases dropped in the two counties.

To better understand why the results were statistically significant, Bos et al. (2008) explains that a gram of fecal matter contains millions of viral pathogens, bacterial pathogens, protozoan cysts, and helminth eggs, which when ingested by humans results in health complications. Due to the high viral and bacterial load, diseases suh as cholera, typhoid, and dysentry are transmitted to humans when they come into contact with fecal matter, and contanimated surfaces or consume contaminated water. Bos et el. (2008) reports that more than 88 percent of global diarrhoea cases are caused by unafe water and insufficient hygiene, resulting in 1.5 million annual deaths. In addition to cause deaths to the public, fecal matter contamination resuls in about half of the underweight cases in children through the correlation between diarrhoea and undernutrition (WHO Report, 2008). Therefore, when high open defaction rates were reported in Kilifi and Marsabit by the MoH and in the Water and Sanitation Report (2012), it was unavodable that the high rate posed

a health risk to residents and was cusative to diseases such as diarrhoea, dysentery, hepatitis A, and typhoid cases in two regions.

However, upon CLTS implementation in Kilifi and Masabit (from November 2020 to November 2021), the two counties experienced a significant drop in the open defaction rates. The drop in this cases resulted in reduced risk of fecal matter contanimantion and reduced morbidity of diseases related to poor sanitation, thus a statistically significant t-test result. Despite the CLTS-attributed drop, the statistical significance of the results was also promoted by other facors, such as the varying levels of socio-economic status. In he review, Fewtrell and Kaufmann (2005) explained that regions with different spcio-economic status report different levels of sanitation awareness and morbidity rates of sanitation-related diseases. The authors showed that a region with better socio-economic status is likely to report increased sanitation awareness and low morbidity rates, thus linking diseases such as diarrhoea to poverty and low literacy levels (Fewtrell & Kaufmann, 2005). Fewtrell and Kaufmann (2005) results imply that despite the statistical significance of the results, other factors such as the improving socio-economic statuses, change in population density, change in rainfall partterns, and change in the rate of cross-border movements in Kilifi and Marsabit also promoted decrease in sanitation-related deaths (Stoltzfus et al., 2014).

Overall, the results showed statistical significance of CLTS programs with proper sanitation practices such as ownership of latrines. However, the rate at which the program reduces OD and poor sanitation practices is slow, making the two regions and the country unable to meet its targets and SDG goals. Under-five children are disproportionally affected by diarhhoea and sanitation-related diseases, implying that despite the positive impact of CLTS and the decreasing rate of sanitation-related diseseases, a significant number of under-fives continue to be impacted by OD

practices in Kilifi and Marsabit. Therefore, there is need for more studies to understand variables that are critical to behavior change and adoption of CLTS measures. Such studies should utilize different theoretical options, such as theory of reasoned action, theory of planned behaviour, social cognitive theory, health belief model, and the trans-theoretical model to determine the most effective theory, regarding adoption and implementation of CLTS measures in Kilifi and Marsabit.

# CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

## 5.1 Introduction

This chapter summarizes the main findings of the study. It reports on the outcome of the null hypothesis, and the answers to all the research questions posed in the introduction chapter. In addition, the chapter outlines the limitations and delimitations of the study. Also, recommendations for future studies, adopted from the study limitations are proposed. Lastly, the chapter outlines various recommendations to various stakeholders, policy-makers, and curriculum developers about CLTS programs and how to make them more effective in achieving total sanitation status in Kenya.

## 5.2 Summary of Findings

### 5.2.1 Null Hypothesis

The current study established statistical significance of CLTS and ownership of sanitation facilities in Kilifi and Marsabit, disapproving the null hypothesis that there was no statistical significance of the programs and sanitation practices. The results show that CLTS program are effective and have positively impacted sanitation status, such as reducing OD levels in Kilifi and Marsabit.

### 5.3.2 Specific Objective 1: ODF Status

The OD rate in Kilifi County is 2.93 percent and 24.45 percent in Marsabit. The average rate is 13.5 percent, slightly lower than the national average of 14 percent. However, considering the levels of OD reported by the MoH and the Water and Sanitation Program before the implementation of CLTS and during the current study (after the intervention), the two regions

persist to face significant levels of OD. The significant open defection levels in the two counties was responsible for the diarrhea cases in the region, with a student t-test analysis showing statistically significant mean difference results. In addition, the under-fives in the two regions are disproportionally affected by sanitation-related diseases, thus vital that factors impacting CLTS effectiveness are investigated to increase positive outcomes, eradicate open defection, and eliminate sanitation-related health complications, especially for under-fives.

### 5.3.3 Specific Objective 2: Level of CLTS Awareness

Marsabit has 23 percent CLTS unawareness level and 77 percent awareness level. Kilifi has 2 percent unawareness and 98 percent awareness levels. Averagely, the two counties reported 87.6 percent awareness and 12.3 percent unawareness levels. When levels of unawareness were compared with open defection behavior, the study established that unawareness was associated with poor sanitary practices. The striking similarity between CLTS unawareness rates and OD levels guides the current study's recommendation that such programs must invest more on awareness levels, even before implementation. It also implies that positive behavior change is most likely to occur if the public are aware of the adverse effects of the current behaviors and how the new measures would mitigate the identified negative effects. The awareness and knowledge is best conveyed through civic education in schools and public health campaigns in the affected communities.

### 5.3.4 Specific Objective 3: Morbidity of Associated Diseases

The mean difference in diarrhea morbidity in Kilifi and Marsabit during the CLTS implementation period was statistically significant. The results show that CLTS programs were associated with lesser cases of diarrhea

### 5.3.5 Specific Objective 4: Factors influencing Effectiveness of CLTS

After analyzing various factors impacting CLTS effectiveness, the study established that sanitation practices were impacted by age, gender, income, education, and handwashing or CLTS awareness. Regarding age and gender, younger adults were found to be unlikely to own sanitation facilities while men were less likely to own facilities and practice sanitation measures than women. In that regard, the current study recommends that CLTS programs target the young generation and men, since these groups are disproportionally impacted. Also, income and education levels were found to significantly impact sanitation measures. As expected, low income earners and those with no education were adversely impacted than high income earners and the educated. Sanitation practices increased with income and education levels to a peak of 10,000 Kenya Shillings monthly income and a college education.

## 5.4 Conclusion

The findings of this study confirms that while CLTS are effective in reducing OD and mitigating health risks linked with poor sanitation, there are disparities in its implementation., it its current form. Therefore, there is urgent need to review the CLTS standard protocols with a view to innovatively addressing different geographic/ climatic zones. In addition, these findings will guide the formulation and implementation of CLTS programs, by identifying factors that require customized approach. For example, future CLTS programs must be gender and age specific,

targeting males and the younger generation who were found to be lagging in sanitation practices. Lastly, the findings will guide curriculum developers, especially in primary and secondary education, towards increasing CLTS awareness at low education levels. Such shift the peak and which education level impacts proper sanitation practices from college to primary education. This will ensure primary school leavers and dropouts are aware and practice proper sanitation measures to mitigate critical public health challenges.

### 5.5 Limitations and Future Research

The study was carried out in only two representative counties in Kenya; thus, the results, therefore, may not be generalized to the entire 47 counties in Kenya. Secondly, the study was carried out just before the general election. Since CLTS programs were implemented by the government, political affiliations may have impacted responses. Those who supported the government may have provided skewed responses showing effectiveness of CLTS while those who did not support the government gave biased negative feedback. The study did not investigate the impact of culture and religion on sanitation practices despite identifying that

### 5.6 Recommendations

#### 5.6.1 Recommendations for Policymakers

i. Enhance policies that provide access and sustainable health services for sanitation-related diseases such as diarrhea.

ii. Provide access to health education regarding prevention, treatment, and management of sanitation-related diseases through media and public posters.

iii. Formulate policies to establish funding and construction of shared-sanitation facilities in areas with low facility ownership rates.

iv. Advocate for more funding to establish sanitation facilities in the highly affected areas

### 5.6.2 Community Advocacy

i. Sensitive communities on awareness of CLTS programs

ii. Promote communal ownership of sanitation facilities, especially at market centers

iii. Promote communal ownership of facilities for the pastoralists communities that do not have permanent residences

***iv.*** Encourage men to take up more sanitation-related roles at family level

### 5.6.3 Recommendations for CLTS Program Developers and Implementers

i. Target men as a more vulnerable gender

ii. Target the young household heads, aged 18-30, as the most vulnerable age group

iii. Use vernacular and local dialects in communicating program objectives to the less literate

iv. Roll out CLTS in areas with high OD rate

v. Emphasize on CLTS awareness before and after roll out to increase adherence levels

### 5.6.4 Recommendations for Curriculum Developers

i. Introduce CLTS concepts at primary education to increase awareness among primary school leavers and dropouts

ii. Introduce basic health education regarding sanitation and sanitation-related diseases at primary level

### 5.6.5 Recommendations for further research Researchers

i. Investigate the impact of religion on implementation and adoption of CLTS

ii. Investigate variables critical for behavior change that promotes proper sanitation measures

iii. Carry out similar study by recruiting participants from every county in Kenya to achieve generalizable results.

iv. Carry out study investigating impact of religious practices on sanitation status. Marsabit was predominantly Muslim while Kilifi residents practiced Christianity. Disregard to religion and culture implies that the study findings do not accurately reflect the status in regions that do not share same religious or cultural beliefs. In future studies, researchers should explore the impact of religion and culture on sanitation practices. Different religious and cultural practices significantly impact ownership of sanitation facilities and adherence to sanitation measures, thus critical that they are considered before drawing conclusions on the effectiveness of CLTS programs in such regions.

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**National Sanitation Coverage**

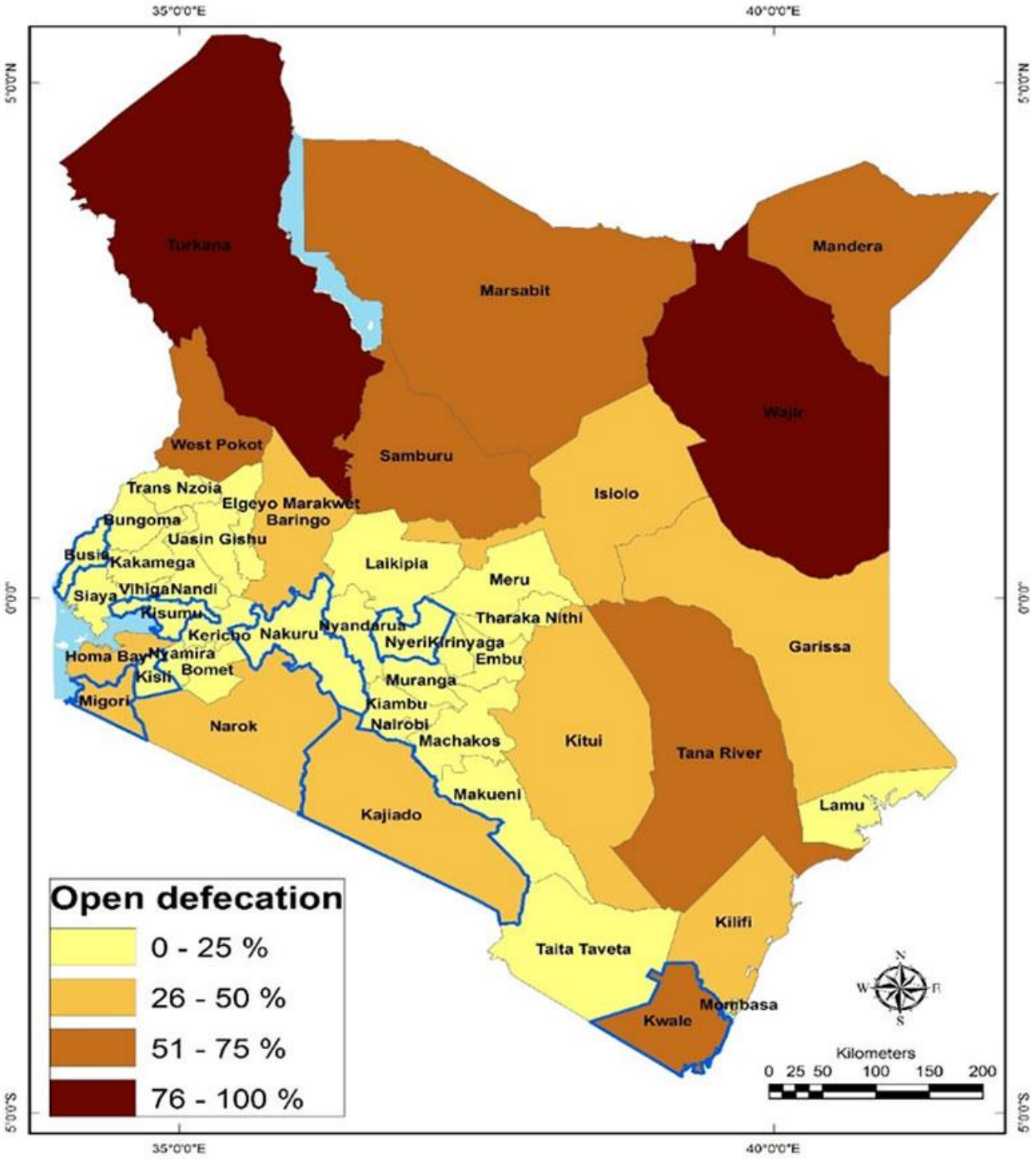


***Figure 3.1: National sanitation Coverage***

## APPENDICES

### Appendix I: Consent Form

**TITLE OF STUDY: DETERMINANTS OF MAJOR INTERVENTIONAL CONCERN ON CLTS AMONG SELECTED POPULATION IN KILIFI AND MARSABIT COUNTIES IN KENYA.**

**Introduction:**

You are being requested to take part in a research project. Tobias Omufwoko, a PHD student at Mount Kenya University, is doing the research. Take your time considering whether to participate in the study. Take the following material into careful consideration, and then ask the study counselor any questions you may have. Your personal information will be kept in the strictest confidence and used exclusively to carry out the stated purposes.

**Purpose of the study**

The purpose of the study is to identify determinants of the effectiveness of CLTS in Kilifi and Marsabit counties, Kenya. You will be required to complete a semi-structured questionnaire for this study, which will take about 15 minutes.

**Benefits**

Although there are no immediate advantages or rewards, the results will assist identify any gaps so that actions can be done to lessen unmet needs.

**Risks and discomforts**

I don't anticipate any risks or discomforts associated with your participation in the study.

**Compensation**

There will be no payment for participating in the study.

**Voluntary participation**

You have the option to cease participating in the study at any time; it is entirely optional. Nobody will be able to influence your choice, and it will be respected.

**Confidentiality**

Participants' privacy will be protected both during the data gathering procedure and after the study. Participants will not enter their names anywhere in the questionnaire to maintain anonymity; instead, codes will be utilized.

If you have any questions concerning the study and would like to contact the researcher, please do so through the following contacts;

Researcher;

**Contact Information**

You are welcome to ask me any questions you may have about this study now or at any point while it is being conducted. You can contact me via email at tomufwoko@yahoo.com or by calling me Tobias Omufwoko at 0722876048. Through jgkariuki@mku.ac.ke, you can also get in touch with the faculty advisor and the dean of the School of Public Health. You can reach the Mount Kenya University Institutional Ethical Review Committee (IERC) office at rsearch@mku.ac.ke if you have any inquiries about how your information will be kept private in this research or if you have been put in danger.

**Legal Rights and signatures;**

I agree to take part in the study that Tobias Omufwoko described above. I've read the entire research description, and I want to willingly engage in the study.

Signature of interviewee.....Date.....

Signature of researcher.....Date.....

**Appendix II: Questionnaire**

**TITLE OF STUDY: DETERMINANTS OF THE EFFECTIVENESS OF CLTS IN KILIFI AND MARSABIT COUNTIES, KENYA.**

## A. Interview Identification

| No | Question | Coding | Skip |
|---|---|---|---|
| 1. | Questionnaire number | | |
| 2. | Division name | | |
| 3. | Village Name | | |
| 4. | Interview date | | |
| 5. | Interviewer name | | |
| 6. | Supervisor | | |
| 7. | Checked by | | |

**INFLUENCING FACTORS**

| | | | |
|---|---|---|---|
| 1 | What is the respondent's sex? Observe | 1. ◯ Male<br>2. ◯ Female | |
| 2 | What is your age? (Respondent's age in completed years) (age must be 18 and above | \| ___ \| ___ \| years | |

| | | | |
|---|---|---|---|
| 3 | How many years has your family lived in this homestead? | \|___\|___\| years | |
| 4 | Are you married? | 1. ◯ Yes<br>2. ◯ No | |
| 5 | What is your Religion? | 1.◯ Christian<br>2.◯ Muslim<br>3.◯ Other | |
| 6 | What is the highest level of education attained? | 1. ◯ Primary<br>2. ◯ Secondary<br>3. ◯ 3. Tertiary<br>4. ◯ (4) None | |
| 7 | What is the family monthly income: | 1. ◯ 5000-10,000<br>2. ◯ 10,000 - 15,000<br>3. ◯ 15,000 - 20,000<br>4. ◯ 20,000 - 25,000<br>5. ◯ 25,000 – 30,000<br>6. ◯ Above 30,000 | |

| | | | |
|---|---|---|---|
| 8 | What is the Climate like in your area, most of the year | 1.◯ Extreme hot and dry<br>2.◯ Moderate: rainy most of the year<br>. | |
| 9 | What is the weather effect on construction of sanitation facilities | 1. ◯ Loose soils<br>2. ◯ Dry/ hard soil<br>3. ◯ Dry vegetation<br>4. ◯ Other (explain) | |
| 10 | What kind of sanitation facility does your family usually uses? | 1. ◯ Bucket toilet<br>2. ◯ Traditional pit latrine<br>3. ◯ Standard Pit latrine<br>4. ◯ Ventilated improved pit latrine (VIP)<br>5. ◯ Composting toilet<br>6. ◯ Pour flush toilet<br>7. ◯ Septic tank<br>8. ◯ None | |
| 11 | Construction: What are the floor/ slab made of? | 1.◯ Sticks or branches and dirt or clay<br>2.◯ Wooden boards | |

| | | | |
|---|---|---|---|
| | | 3.◯ Concrete/Cemented<br>4.◯ Plastic<br>5.◯ Other (specify) | |
| 12 | Construction: What are the walls made of?<br>(observe) | 1.◯ Walls are completely deteriorated or collapsed<br>2.◯ Walls are made of a temporary material such as straw or palm leaves<br>3.◯ Walls are made of durable material such as wooden boards, wood plastered with mud, concrete/Cement, or adobe | |
| 13 | What is the roof made of (observe) | 1.◯ Thatch/ sticks/ leaves<br>2.◯ CGI/ tin<br>3.◯ None/ open<br>5.◯ Other (specify) | |
| 14 | What is the main source of water for members of your household? | PIPED WATER<br>1.◯ Pipe into Dwelling<br>2.◯ Pipe to yard/plot<br>3.◯ Pipe to neighbor<br>4.◯ Public tap/standpipe | |

| | | | |
|---|---|---|---|
| | | BOREHOLE OR DUG WELL<br>5.◯ Unprotected well<br>6.◯ Protected well<br>WATER FROM SPRING<br>7.◯ Protected spring<br>8.◯ Unprotected spring<br>OTHER SOURCES<br>9.◯ Rainwater harvesting<br>10.◯ Tanker truck<br>11.◯ Care with small tank<br>12.◯ Surface water(river/dam/lake/pond/ stream/ canal/irrigation channel)<br>13.◯ Bottled water<br>14.◯ Other (specify): | |
| 15 | In the last two weeks, was water unavailable from this source for a day or longer? | 1.◯ Yes<br>2.◯ No | |
| 16 | Where is your main source of water located? | 1. ◯ In the dwelling<br>2. ◯ In the yard/plot<br>3. ◯ Elsewhere, | |
| | **MORBIDITY** | | |

| | | | |
|---|---|---|---|
| 17 | How many children under 5 years and below are living in this household? | \| ___ \| ___ \|people | |
| 18 | Is any of the under five children having diarrhea in the last two weeks of time? | 1. ◯ Yes<br>2. ◯ No | |
| 19 | How many times did the youngest child develop diarrhea in the last three months? | _____ times | |
| 20 | What do you think is the main cause of diarrheal diseases? | 5. ◯ Witchcraft<br>6. ◯ Poor sanitation<br>7. ◯ Weather<br>8. ◯ Don't know | |
| 21 | The last time an under five child in your household passed stool, where did he/she defecate? | 1. ◯ Used potty<br>2. ◯ Used diaper<br>3. ◯ Went in his/her clothes<br>4. ◯ Went in house/yard<br>5. ◯ Went outside the premises<br>6. ◯ Used own sanitation facility<br>7. ◯ Used public latrine | |

| | | | |
|---|---|---|---|
| | | 8. ◯ Don't know | |
| 22 | The last time a child in your house passed stool, where were his/her feces disposed? | 1. ◯ Dropped into toilet facility<br>2. ◯ Buried<br>3. ◯ Solid waste/trash<br>4. ◯ In yard<br>5. ◯ Outside premises<br>6. ◯ Into sink or tub<br>7. ◯ Thrown into waterway<br>8. ◯ At the well<br>9. ◯ Don't know | |
| **AWARENESS** | | | |
| 23 | Where do members of your family usually go to defecate? | 1. ◯ Bush, field, river, or pond<br>2. ◯ Dig and burn<br>3. ◯ Latrine at their own household<br>4. ◯ Neighbor's household<br>5. ◯ Communal or public latrine<br>6. ◯ Other (specify): | |
| 24 | Have you heard of the CLTS Approach? | 1. ◯ Yes<br>2. ◯ No | |

| | | | |
|---|---|---|---|
| 25 | What does the CLTS approach entail? | 1. ◯ Pre-triggering<br>2. ◯ Triggering<br>3. ◯ Call for action<br>4. ◯ Follow ups<br>5. ◯ Don't know<br>6. ◯ Other (specify) | |
| 26 | What is the importance of CLTS approach? | 1. ◯ Health education/ Promotion<br>2. ◯ Prevention of diseases<br>3. ◯ Increase in latrine coverage<br>4. ◯ Other (specify) | |
| 27 | Do you have and use a sanitation facility? | 1. ◯ Yes<br>2. ◯ No | |
| 28 | What are the challenges of sharing a sanitation facility with other households? | 1. ◯ May spread infections<br>2. ◯ May not be used regularly due to proximity/ convenience<br>3. ◯ None<br>Other (specify | |
| 29 | Is this latrine accessible at all times: day and night? | 3. ◯ Yes<br>4. ◯ No | |

| | | | |
|---|---|---|---|
| 30 | Do you think people not using latrines are a health risk in your village? | 1. ◯ Yes<br>2. ◯ No | |
| 31 | Do you and your family members wash your hands at all of times you visit the latrine? | 1. ◯ Always<br>2. ◯ Sometimes<br>3. ◯ Never | |
| 32 | Please mention all of the occasions when is it important to wash your hands.<br>• *Do **not** read the answers.*<br>• *Circle all responses.*<br>• *After they have finished responding, ask "are there any more times?"*<br>*If the respondent indicates that she/he does not know, do not probe for additional responses* | □Before eating<br>□After eating<br>□Before praying<br>□Before breastfeeding or feeding a child<br>□Before cooking or preparing food<br>□After defecation/urination<br>□After cleaning a child that has defecated/changing a child's nappy<br>□When my hands are dirty<br>□After cleaning the toilet or potty<br>□In the morning<br>□Other (specify): | |

| | | | |
|---|---|---|---|
| 33 | Do you think not washing hands has health risk to you and your family? | 1. ◯ Yes<br>2. ◯ No | |
| 34 | What is the status of CLTS is the available latrine (Observe) | 1.Basic<br>2. minimum<br>3. improved | |
| 35 | Would you be willing to pay for use of a sanitation facility? | 1.◯ Yes<br>2.◯ No | |

**OBSEVATION CHECKLIST REINFORCING HANDWASHING AWARENESS**

| | | | |
|---|---|---|---|
| 36 | Observe: Is there a hand washing station inside the latrine or near to the latrine? | 1. ◯ Yes<br>2. ◯ No | |
| 37 | Observe: Is there water at this hand washing station? | 1. ◯ Yes<br>2. ◯ No | |
| 38 | Observe: What device is used for water at this hand washing station? | 1. ◯ Tap<br>2. ◯ Tippy tap<br>3. ◯ Bucket<br>4. ◯ Wash basin | |

| | | | |
|---|---|---|---|
| | | 5. ◯ Other (specify): | |
| 39 | Observe: Is there a hand washing material at this hand washing station inside/near the latrine?<br>• | 1. □□None<br>2. □□ Soap<br>3. □□Detergent<br>4. □□ Ash<br>5. □□ Mud/sand | |
| | | 6. □□ Other (specify): | |
| | | | |

| | | | |
|---|---|---|---|
| 40 | Observe: Is there visibly used anal cleansing material in the latrine or in the pit? | 1. ◯ Yes<br>2. ◯ No | |
| 41 | Observe: Are there fresh or recent feces evident in the pit? | 1. ◯ Yes<br>2. ◯ No | |
| 42 | Observe: Are there flies present inside the latrine? | 1. ◯ Yes – more than 10 flies<br>2. ◯ Yes – less than 10 flies<br>3. ◯ No | |
| 43 | Observe: Maintenance: Is there a drop-hole cover? | 1. ◯ No hole cover present | |

| | | | |
|---|---|---|---|
| | | 2. ◯ Hole cover defective, broken, or not used<br>3. ◯ Hole cover placed over hole and tight fitting | |
| 44 | Observe: Maintenance: What privacy does the latrine have? | 1. ◯ User visible from outside (no walls, or walls do not provide privacy to user).<br>2. ◯ Cosmetic issues in need of repair, even though user is not visible from the outside.<br>3. ◯ Walls in sufficient repair to provide privacy. | |
| 45 | Observe: Maintenance: How clean is the hole/opening area of the latrine? | 1. ◯ Dry and clean<br>2. ◯ Dry but smeared with shit<br>3. ◯ Wet but no smeared shit<br>4. ◯ Wet and smeared with shit | |
| 46 | Observe: What is the general cleanliness of the compound | 1. ◯ Very clean<br>2. ◯ Average<br>3. ◯ Untidy<br>4. ◯ Very untidy | |

## Appendix III: Letters and Certificates

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **137139**

Date of Issue: **13/July/2022**

**RESEARCH LICENSE**

**This is to Certify that Mr.. Tobias Mbeya Omufwoko of Mount Kenya University, has been licensed to conduct research in Kilifi, Marsabit on the topic: DETERMINANTS OF THE EFFECTIVENESS OF COMMUNITY-LED TOTAL SANITATION IN KILIFI AND MARSABIT COUNTIES, KENYA for the period ending : 13/July/2023.**

License No: **NACOSTI/P/22/18789**

**137139**

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

# COUNTY GOVERNMENT OF KILIFI

## DEPARTMENT OF HEALTH SERVICES

**When Replying quote**
**Email: chmtkilifi@gmail.com**
**REF: KLF/DOH/RESEARCH /VOL.2/187**

**P. O. Box 9-80108**
**Kilifi**
**Date: 1 December 2022**

## OFFICE OF THE COUNTY DIRECTOR

Tobias Mbeya Omufwoko
REG: PHD PH/2017/67527
Mount Kenya University
**Thika.**

Dear Sir,

**RE: DEPARTMENTAL AUTHORIZATION TO CARRY OUT RESEARCH ON DETERMINANTS OF THE EFFECTIVENESS OF COMMUNITY LED TOTAL SANITATION AMONG SELECTED POPULATION IN KILIFI AND MARSABIT COUNTIES, KENYA.**

The Kilifi County Department of Health Services is in receipt of your email requesting to conduct a study on "**Determinants of the effectiveness of Community Led Total Sanitation among selected population in Kilifi and Marsabit counties, Kenya**" together with the protocol, institutional ethical and scientific approval **MKU/ERC/2254**, NACOSTI permit **Ref: NACOSTI/P/22/18789.**

The Department is pleased to grant you authorization to conduct your study within Kilifi County in line with ethical consideration and approved study protocol, and within the expiry date of your ERC approval **21st June, 2023.** Kindly adhere to the guidelines for conduct of research during the time of study.

It is required that you engage the subcounty administration for Rabai prior to commencing data collection.

Upon completion of the study, you will be required to share your study findings, conclusion and recommendations with the Department of Health Services, Kilifi County.

Sincerely,

COUNTY DIRECTOR HEALTH * KILIFI COUNTY * P.O. BOX 9 KILIFI
01 DEC 2022

Dr. Hassan Leli
Ag. Director Health Services
**Kilifi County**

CC

- CECM – Health Services
- Chief Officer Health Services
- Heads of Division

# Mount Kenya University

## DIRECTORATE OF GRADUATE STUDIES

**PHDPH/2017/67527**

8th July, 2022

*The Director, Research Coordination Division*
*National Commission for Science, Technology & Innovation*
*Utalii House, 8th & 9th Floor*
*P.O Box 30623- 00100*
*NAIROBI*

Dear Sir/ Madam,

**RE: TOBIAS MBEYA OMUFWOKO – REGISTRATION NO. PHDPH/2017/67527**

The purpose of this letter is to introduce the above named student who is pursuing **Doctor of Philosophy in Public Health** in the **Department of Community Health, Epidemiology and Biostatistics** in the **School of Public Health.**

The title of her research is ***"Determinants of Major Interventional Factors on Community – led Total Sanitation among Selected Population of Kilifi and Marsabit Counties, Kenya."***

She has been cleared by the University's Ethics Review Committee (Certificate attached) and now has to proceed to the field to collect data for her research between **July and January, 2023.**

Any assistance accorded to her will be highly appreciated.

Thank you.

Mount Kenya University
P. O. Box 342 - 01000, THIKA
Office of the Director
Graduate Studies

**Dr. Samuel M. Kareniga, Ph.D**
**Director, Graduate Studies**
**Enc.**

# Mount Kenya University

REF: **MKU/ERC/2254**

Date: 22 June 2022

TO: **TOBIAS MBEYA OMUFWOKO**

REG: **PHDPH/2017/67527**

Dear Sir/Madam,

**RE: DETERMINANTS OF MAJOR INTERVENTIONAL FACTORS ON COMMUNITY-LED TOTAL SANITATION AMONG SELECTED POPULATION OF KILIFI AND MARSABIT COUNTIES, KENYA**

This is to inform you that **Mount Kenya University** has reviewed and approved your above research proposal. Your application approval number is **1327.** The approval period is **22/06/2022 - 21/06/2023.**

This approval is subject to compliance with the following requirements;

i. Only approved documents including informed consents, study instruments, MTA will be used
ii. All changes including amendments, deviations and violations are submitted for review and approval by **Mount Kenya University**
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to **Mount Kenya University** within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to **Mount Kenya University** within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal
vii. Submission of an executive summary report within 90 days upon completion of the study to **Mount Kenya University**

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely,

The Chairman
Mount Kenya University
Ethics Review Committee
P. O. Box 342 - 0100, Thika

**Dr. Peter G. Kirira**
**Chairman, Mount Kenya University IERC**

**Appendix IV: Similarity Index Document**

# TOBIAS MBEYA OMUFWOKO_8th March 2024

*by* User User

**Submission date:** 08-Mar-2024 04:55AM (UTC-0500)
**Submission ID:** 2315048216
**File name:** TOBIAS_MBEYA_OMUFWOKO_8th_March_2024.doc (6.39M)
**Word count:** 51687
**Character count:** 293653

TOBIAS MBEYA OMUFWOKO_8th March 2024

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