

**AN ASSESSMENT OF THE HOUSING AND ENVIRONMENTAL  
CONDITIONS OF BONDENI ESTATE IN NAKURU TOWN, KENYA**

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## DECLARATION

This project is my own original work and has not been presented for award of any degree in any university

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## **DEDICATION**

I dedicate this work to my beloved wife, Zipporah Arisi, and my son, James Obwogi,  
who have inspired me to pursue higher education

## **ACKNOWLEDGEMENT**

First and foremost, I am indebted to the University of Nairobi for allowing me to pursue postgraduate studies degree in Urban Geography. The resources provided by the University of Nairobi, support from the Faculty, and proper guidance during my study period is invaluable. I acknowledge my supervisors, Prof. Samuel Owuor and Dr. Jacqueline Walubwa, as well as my lecturers at Department of Geography and Environmental Studies for their utmost encouragement and support while undertaking this project. My special thanks goes to my employer, Teachers Service Commission, for granting me study leave; my school Principal, Mr. Hassan Rajab, for giving me ample time and encouragement; as well as my colleagues with whom we have worked to realize our academic dreams. I extend my gratitude to residents of Bondeni estate. Their proper association and structures facilitated proper data collection during my study. My family's resilience during the period of my study is well commendable, by providing a comfort zone when I sought help and support, financially and morally, I recognize their assistance, and it was overwhelming.

## ABSTRACT

The study is an assessment of the housing and environmental conditions of Bondeni estate in Nakuru Town, Kenya. The study argues that informal settlements are characterized by several environmental challenges, including poor housing conditions that need to be clearly understood and investigated. Furthermore, concern has been raised on existence of health hazards presented through housing and environmental conditions such as poor drainage and sewerage, water and air pollution, as well as deplorable state of sanitation facilities. The specific objectives of the study were to establish the housing conditions in Bondeni informal settlement; to examine the environmental conditions in Bondeni informal settlement; to determine Bondeni residents' opinion on their housing and environmental conditions; and to assess the potential effects of housing and environmental conditions on quality of life among Bondeni residents. The study used not only primary data sources but also secondary data sources to achieve its objectives. The collection of primary data involved the use of a structured and semi-structure questionnaire and direct field observation by the researcher. The pre-coded questionnaire sought information on respondents' and household characteristics, housing conditions, sources of energy, drainage and sewerage, water supply, sanitation facilities, and residents' opinion on their housing and environmental conditions. The collection of secondary data involved reviewing and utilization of relevant literature and government publications. The study results are based on a sample of 74 households randomly drawn from 6,148 households in Bondeni. The study found out that most of the households lived in rented houses (78.4%); used charcoal and firewood as their main source of cooking energy (71.7%); had challenges in disposing their solid wastes (59.7%); and used shared flush toilets (87.7%). The study found that poor environmental and housing conditions in Bondeni have negatively impacted the residents' quality of life. This study recommends the need to give this problem a top priority so as to improve the housing and environmental conditions in informal settlements.

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## CHAPTER ONE: INTRODUCTION

### 1.1 Statement of the Research Problem

According to World Bank (2011), it is estimated that about one billion people in the world live in slums and that a large proportion of these people are in developing countries. These settlements are commonly occupied by the urban poor who are highly vulnerable to poor health caused by dilapidated environment and housing conditions. Urban population in the world is projected to rise with a margin of about 2.7 billion by 2050 (ESMAP, 2014). Most of this population increase will be residing in third world countries resulting to several urban challenges like inadequate infrastructure and housing, lack of basic sanitation facilities, and exposure of urban residents to poor environmental conditions that may lead to poor health conditions (UNDESA, 2012). In addition, poor solid waste disposal practices are argued to negatively impact on human health (Muoria et al., 2019).

In many of the world cities, housing conditions in informal settlements are known to be in a deplorable state, lack basic facilities, and are in most cases located in places that are not safe nor secure for human settlement (Bramley et al., 2010). Urban informal settlements are densely populated with inadequate housing (Addo, 2013). Despite the fact that housing in these settlements is in a deplorable situation, it still remains a basic necessity in any society (UN-Habitat, 2012). Housing and environmental hazards affect human health as a result of indoor air quality, indoor temperatures, crowding, lack of hygiene, and poor sanitation. Moreover, the neighborhoods also represent an environment that can accelerate or decelerate the residents' physical, mental and social development. For example, lack of basic sanitation facilities exposes urban residents to poor environmental conditions that may lead to poor health.

Lamond et al (2013) observed that poor waste management contributes to urban flooding, blocks drainages, increases debris and harbours disease vectors. According to UNICEF (2010), a large number of people in developing countries lack descent toilets or pit latrines up to the extent that they are forced to defecate on an open ground, while others make long queues in order to use the sanitation facility. This



situation puts people in unhygienic conditions that may attract diseases such as diarrhoea, cholera, bilharzia and typhoid.

Kenya Vision 2030 is anchored on economic, social and political pillars. Part of the Vision is to improve the quality of life of all Kenyans, including those living in slums. However, this may not be achieved if environmental health hazards are not adequately addressed. Concern has been raised on existence of health hazards presented through housing and environmental conditions such as sources of cooking energy, poor drainage and sewerage, pollution of drinking water, as well as deplorable state of sanitation facilities. According to the Owusu (2010), informal settlements lack basic facilities and services that can compromise housing and environmental conditions of the residents. WHO (2010) shows that unhygienic condition in informal settlements leads to diseases such as diarrhoea and cholera. Furthermore, indiscriminate solid waste disposal and dumping waste in the open provides fertile grounds for vectors breeding such as mosquitoes, rats, fleas and flies.

More specifically, Nakuru town has been facing health hazard related challenges, which if not addressed are likely to affect the resident's quality of life. Owing to the ever increasing population in Nakuru, housing and environmental conditions are in despair and needs much improvement (Kanani, 2014). This ballooning population has attracted a high demand for provision of essential facilities and services like housing, sanitation facilities and water, hence overstressing the available resources and over burdening the county government in addressing the residents' needs. As such, this study is an assessment of the housing and environmental conditions of Bondeni informal settlement in Nakuru Town, Kenya.

## **1.2 Research Questions**

1. What are the housing conditions in Bondeni informal settlement?
2. What are environmental conditions in Bondeni informal settlement?
3. What are Bondeni residents' opinions on their housing and environmental conditions?
4. What are the potential effects of housing and environmental conditions on quality of life among Bondeni residents?

### **1.3 Research Objectives**

The broad objective of this study is to assess the housing and environmental conditions of Bondeni informal settlement in Nakuru Town, Kenya. The specific objectives are to:

1. Establish the housing conditions in Bondeni informal settlement.
2. Examine the environmental conditions in Bondeni informal settlement.
3. Determine Bondeni residents' opinions on their housing and environmental conditions.
4. Assess the potential effects of housing and environmental conditions on quality of life among Bondeni residents.

### **1.4 Significance of the Study**

The study results are useful to the County Government of Nakuru for planning purposes, as well as improving and enhancing the housing and environmental conditions of Nakuru residents. An understanding of the housing and environmental conditions and how they affect quality of life is useful for urban planning purposes. Furthermore, other stakeholders, social actors, Non-Governmental Organizations and the residents will be able to appreciate the effects of poor housing and environmental conditions on quality of life and thus make efforts of mitigating the effects.

### **1.5 Scope and limitations of the Study**

The assessment of housing and environmental conditions of Bondeni informal settlement in Nakuru Town, Kenya has been achieved with specific interest on the housing conditions, environmental conditions and the residents' opinion on their housing and environmental conditions and potential effect on quality of life. The major limitation of the study was that it was carried out in an informal settlement with the risk of security and finding respondents at home. However, the researcher talked to the local leaders and explained the academic purpose of the study.

### **1.6 Operational Definitions and Concepts**

**Environmental conditions:** This is the state of the physical environment in terms of drainage, sewer and sanitation conditions.

**Housing conditions:** This is the state of the house in terms of roofing, wall, floor and dwelling conditions.

**Quality of life:** This is the individual's self-evaluation on the achievements made in life that makes the individual feel satisfied in life. The achievements can be the physical health and the social aspects of life.

## **CHAPTER TWO: LITERATURE REVIEW**

The chapter is divided into seven sections. The first section gives an overview of urbanization and informal settlements. The second section presents the concept of housing and housing conditions. The third section is on urban environmental health and quality of life. The fourth section presents human health implications of poor housing and environmental conditions. This is followed by the research gaps, theoretical framework and the conceptual framework.

### **2.1 Urbanization, Housing and Informal Settlements**

There is no doubt that Africa is an urbanizing continent. Urbanization in Africa is attributed to cities' natural increase and rural-urban migration (Nabutola, 2010). According to United Nations Population Division (2008), the urban population in Kenya has continued to grow in absolute terms and is projected to rise to 26.6% of the country's population by 2020. On the other hand, Nakuru town's population grew from 231,262 in 1999 to 307,990 in 2009 and was projected to rise to 395,291 by 2012 (Republic of Kenya, 2008). According to Republic of Kenya (2012), Bondeni informal settlement is densely populated, has inadequate and is in a deplorable state. The houses are made of mud walls and tin roofs. The settlement has poor street lighting, poor solid waste management, and poor drainage and sanitation facilities.

According to World Bank (2011), it is estimated that about one billion of the six billion human populations on earth live in slums and that a large proportion of people in the developing nations live in informal settlements. According to UNFPA (2007), about 73% of the total urban population in Africa live in informal settlements, compared to 55% in South Asia.

The definition of a slum or informal settlement differs from one state to another. According to UN-Habitat (2008) a slum is a settlement lacks one or more of the following: clean and safe drinking, sufficient living space, access to sanitation facilities and durable housing. However, Pelling & Wisner (2009) offer a wider definition of an informal settlement as a settlement with structures that are illegal and are erected on dangerous conditions because they reside in such places that lack basic

social amenities, proper housing and even essential services from government agencies. More specifically, a slum environment more often than not lacks good houses, water facilities, proper sanitation, security and the residents have little or no security of land tenure (UN-Habitat, 2009).

Tairo (2013) observed that slum upgrading in Kenya has been a total failure. Using an example of Kibera Slum Upgrading Project, the study found that some of the beneficiaries of the project ended up renting up their houses while finding their way back to the slums. Moreover, the study established that politics was always a major impediment to slum upgrading efforts. This means slum upgrading still is a challenge in Kenya. Ndungu (2012) in a study in Mavoko Sustainable Neighborhood Program in Machakos County found that the Kenya Slum Upgrading Program was faced with a myriad of implementation challenges.

However, Walubwa (2010) found that Kibera Integrated Water Sanitation and Waste Management (K-WASTSAN) Project had a positive impact on the lives of Soweto East residents in terms of increased access to water and sanitation and enhanced accessibility and environmental conditions. The success of the project was mainly because it had deliverables related to quality of life. Furthermore, it was found that the principles of participation and sustainability had been reinforced during project implementation.

## **2.2 The Concept of Housing and Housing Conditions**

Housing is a complex construct that can be easily mistaken to mean the physical structure of a home. However, housing can be viewed as a multidimensional concept with four layers: the dwelling's physical structure, the home, the immediate environment, and the surrounding community. In every dimension there is a series of effect which could have a direct or indirect effect on health. Each dimension has the potential to influence the state of health physically, socially and mentally. Therefore, housing conditions play a basic role to an individual and to the whole public health at large.

A home is considered to be safe and complete when it provides psychosocial benefits (Mahmoud, 2017). Poor dwelling conditions may attract direct health effects. Structurally, the design and quality of the dwelling unit is vital in determining the potential safety risks, social functions of the dwelling and its limitation to the physically challenged residents. In addition, crowding, exposure to noise and other health-related aspects are also influenced by the design and general layout of the dwelling (Stewart, 2013; Stafford & Marmot, 2003; Cohen et al., 2003).

According to the Hindu (2016), a good house must have power backup, water supply, security services, lifts, parking space, recreational facilities, access to common spaces, waste disposal, and ventilation. Baqutayan et al (2015) argues that a good house is a place that is structurally designed to provide not only a feeling of self-actualization but also a place for growth and physical, emotional and social development of the inhabitants. Olotuah (2016) argues that housing is the aggregate of all the components in a residential neighbourhood with all the necessary services, amenities and utilities.

### **2.3 Urban Environmental Health and Quality of Life**

According to WHO (2002) hazards are occurrences that may result to death, decline of health in general, change of environment negatively that may call help or intervention from areas that are not directly affected by the event. Hazards more often than not cause loss of human life, destroy property, destruct economic activities and cause change in the environment and surpass the coping capacities of the affected households. Environment is the totality of all those conditions that surround man at any place and time (Miller, 1976).

According to UNEP (2011), access to drinking water, sanitation, water-borne diseases, solid waste, air pollution, transport, energy and sustainable construction are some of the environmental health issues affecting many urban centres. Urban and rural environments are quite different and therefore their environmental challenges are quite different. Urban areas have more people in a small space and as such densely populated. The high concentration of people in urban areas is advantageous in that it becomes easier to manage the environment by providing the essential facilities such as waste water treatment and public transport.

Quality of life can be viewed as a multi-layered concept because it examines the quality of life at an individual level, a family level and at the community level. It also has different geographical scales such as street, city, state and country levels (McCrea et al., 2005). The quality of life in urban areas is heavily influenced its natural, built, social and economic environment. Khairulmaini & Fauza (2010) opines that environmental conditions in urban areas generates a wide range of social impacts. The quality of urban environments may impair human health, affect human comfort, cause economic and livelihoods losses, or destroy the ecosystem on which both urban and rural areas rely upon. On the other hand, Kobau et al. (2010) defines health-related quality of life as it relates to the physical, emotional, mental and social satisfaction.

Rugh (2012) examines two indices of the physical quality of life. That is, percent of children under 5 that are underweight and the minimum per capita health expenditures. Both reveal the impact of various environmental challenges such as nutrition and pollution. The first is a static value that assesses the current nutrition and the general health while the second index assesses the nation's access to medical services. Arguably, environmental health hazards influence not only the physical quality of life, but other forms such as social and economic quality of life.

According to Myers (1988), quality of life can be measured in terms of: (1) the personal well-being approach which measures an individuals' life satisfaction; (2) the livability comparison approach which compares different urban areas in respect to a number of quality of life indicators; (3) the market or resident approach which uses housing price and/or wage differentials as proxies for the differences in quality of life between urban areas; and (4) the community trends approach which emphasizes the role of quality of life in development. Table 2.1 provides the indicators of quality of life at housing, neighbourhood and city levels.

**Table 2.1: Measures of Quality of Life**

<b>Housing Level</b>	<b>Neighborhood level</b>	<b>City Level</b>
<b>Physical features</b> Dwelling age; Size; Tenure; Characteristics of housing in the local area; Location in urban area	<b>Physical features</b> Neighbourhood landscaping; Crowding; Street lighting; Access to facilities; Noise levels; Quality of the environment; Public transport; Parks and green areas; Education (schools' quality)	<b>Physical features</b> Physical environment; Climate; Pollution
<b>Social features</b> Characteristics of neighbours; Community size	<b>Social features</b> Interactions with neighbours; Privacy; Outdoor space; Community ties; Crime	<b>Social features</b> Crime and safety; Social facilities; Education; Health; Recreation and leisure; Social order; Local facilities
<b>Economic features</b> Home or rent value	<b>Economic features</b> Neighbourhood home values; Community living standards; Neighbourhood socio-economic characteristics; Surrounding improvements	<b>Economic features</b> Standard of living; Employment opportunities

Source: Janzen (2003)

#### **2.4 Human Health Implications of Poor Housing and Environmental Conditions**

WHO (2013) estimates that about 30 percent of the disease burden is as a result of environmental risk factors. A study in New Zealand indicated that there is a strong relationship between damp housing conditions and poor respiratory health. This was revealed by poor health results as manifested in the high hospital admission cases, low



school enrolment and high absenteeism from places of work (Grimes et al., 2012). As such, housing quality can be improved by insulation, ventilating, heating and crowding reduction (Howden-chapman et al., 2013). Naeher et al (2007) noted that fumes emitted from biomass fuels in simple stoves have poisonous particles and causes indoor pollution.

Schwela (2012) identified urban outdoor pollution as a critical form of environmental health hazard. It is estimated that about 49,000 premature deaths occur annually in Africa due to urban outdoor pollution. Informal settlements are often situated close to industries and a long busy roads, exposing slum dwellers to the heavy burden of respiratory diseases. On the other hand, Lamond et al (2012) noted that poor waste disposal increased the likelihood of urban flooding by blocking drainage systems. According to WHO (2013) poor solid wastes disposal can lead to clogged drainage, flooding, and stagnant water that provide conducive breeding grounds for mosquitoes, flies and rodents and as such increasing the risk of spreading diseases.

In addition, when wastes are burnt openly they can emit poisonous substances and cause air pollution. Poor liquid and solid waste disposal increases exposure to disease vectors, for instance mosquitoes, and poses a health risk in these areas (WHO, 2006). Poor solid waste disposal practices are argued to negatively impact on human health, especially on people suffering from asthma and pulmonary diseases (Nnorom & Osibanjo, 2009).

Olukanni et al (2014) found that urban drainage systems are ineffective because of poor maintenance, dumping of solid wastes indiscriminately in drains, and construction of illegal structures over the drains which impede the smooth flow of water According to Offiong et al (2009), Nigeria faces a challenge of poor drainage systems that causes urban flooding during rainy seasons.

In a study in Kisumu, Kenya, Simiyu (2015) noted that the use of communal sanitation facilities is influenced by such factors as location, maintenance practices, income levels and gender. According to Kagiri (2007), effective sanitation is very essential for human health. Women, girls and children are more vulnerable to poor

and inadequate sanitation. According to Owusu (2010), the urban poor in Ghana are more likely to package their liquid and solid waste in plastic bags and dump them anywhere within the community. In Kigali, informal settlement dwellers experience challenges of poor sanitation largely because of lack of money (Tsinda et al., 2013).

According to Oxfam (2009), poor sanitation may predispose urban dwellers to poor health. Consequently, they suffer from common communicable diseases like tuberculosis, malaria and common cold, and water borne diseases such as cholera, typhoid and bilharzias. Poor access to water, sanitation and hygiene are important risk factors for morbidity child mortality (Arnold, 2013).

Blackwell & Fawcett (2008) argues that provision of adequate sanitation is the foundation of social development. Almost 3 billion people lack access to adequate and descent toilets or pit latrines up to the extent they are forced to defecate on an open ground while others make long queues in order to use the sanitation facility (UNICEF, 2010). This situation puts people in unhygienic condition that leads to diarrhoea, typhoid, cholera and dysentery. As such, hygiene-related diseases can be reduced through the provision of clean water, good sanitation and hygiene services.

Muhele (2016) studied the factors influencing sanitation practices in Kibera, Nairobi, Kenya. According to this study, a large proportion of the Kibera residents use water vendors as their main source of water. They also use pit latrines which they paid for. In addition, some households burnt their solid waste while others disposed the wastes in any open spaces. In the same informal settlement (Kibera, Nairobi), Karanja & Ng'ang'a (2008) did a study on women, hygiene and sanitation. The study acknowledged the role of nurses in assisting slum women air their views on how best their sanitation and hygiene conditions can be improved. The study brought to focus such challenges as lack of privacy, money to pay for sanitation facilities, water, enough space and security, as well as sexual harassment, waterborne diseases, and lack of security.

According to Kagiri (2017), the distance of the toilet from the users is important due to positive and negative effects. Effective sanitation is very essential for health.

Women, girls and children are the most vulnerable to poor sanitation. COHRE et al (2007) analyzed the right to access to water and sanitation facilities in Kibera with an objective of collecting data on availability, adequacy, affordability and accessibility of essential services. They emphasized on sanitation, water and refuse collection. Their study revealed that Kibera households were paying KSh 100-150 per cubic metre of water – a figure which is 10 times more than the normal price of piped water. The sanitation facilities were also inadequate as about 150 people shared one toilet.

## **2.5 The Study Gap**

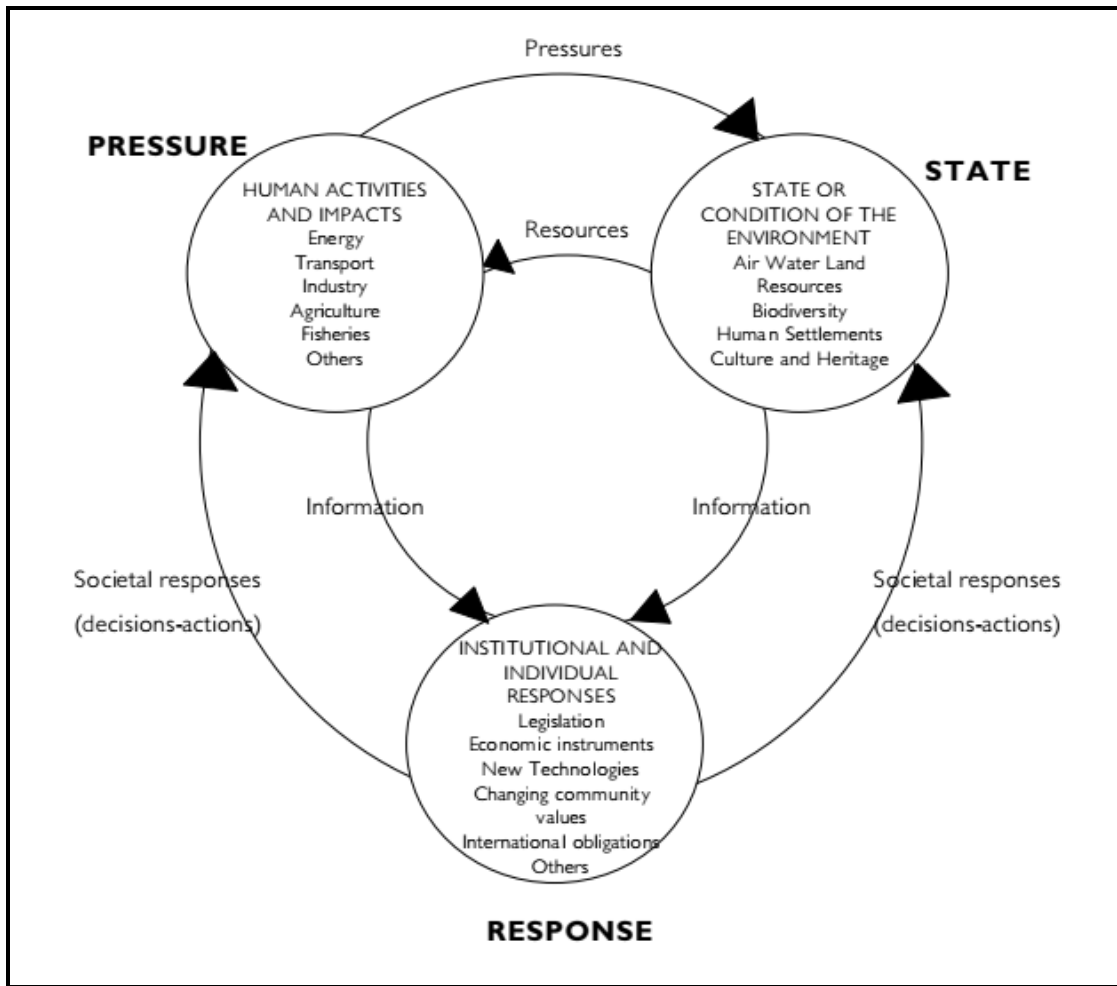
Most of the empirical studies cited above have focussed on provision of basic infrastructural facilities such as roads, sanitation facilities, drainage, solid waste management and electricity. However, there is limited knowledge on the effect of housing and environmental conditions on quality of life.

## **2.6 The Theoretical Framework**

This study uses the Pressure, State and Response framework (Figure 2.1). According to WHO (2002), this is a descriptive representation of the way in which different driving forces create pressures that affect the environment conditions and ultimately human health, through the varied exposure pathways by which people come into contact with in their environment.

Various factors contributing to health and environmental problems may be associated with such driving forces as population growth, economic development, technological change and the policies underlying them. Pressures may be exerted on the environment which cause development sectors to produce a variety of outputs (for example in the form of pollutant emissions), causing the state (quality) of the environment to be deteriorated through the spread and accumulation of pollutants in various environmental media, such as air, soil, water and food. People may be exposed to potential hazards in the environment when they come into direct contact with these media, through breathing, drinking or eating.

**Figure 2.1: Pressure, State and Response Model**

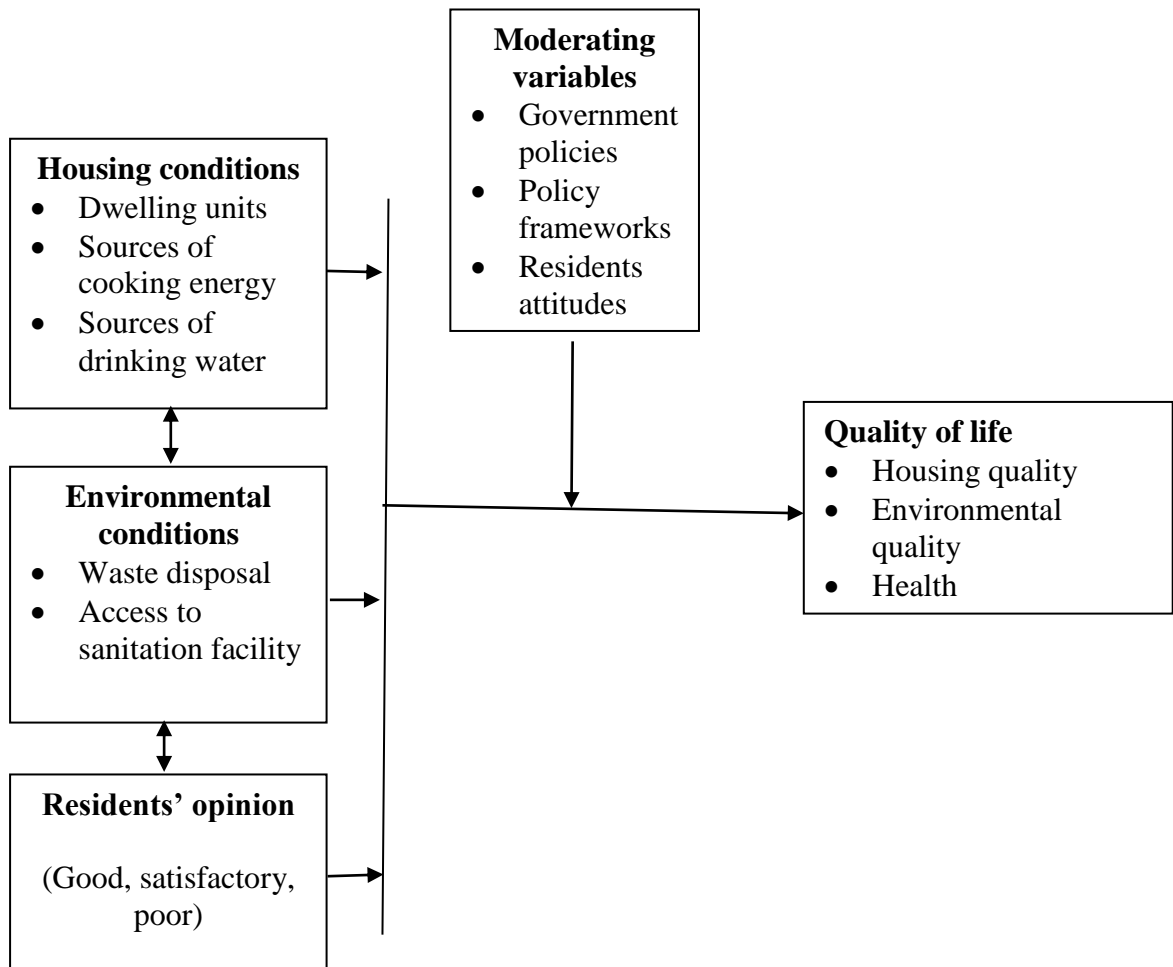


Source: WHO (2002)

## 2.7 Conceptual Framework

This study conceptualises that housing and environmental conditions (independent variables) have an effect on the quality of life (dependent variable) (see Figure 2.2). Housing and Environmental conditions in this case include: dwelling units, main sources of energy, main sources of drinking water, disposal of liquid waste, disposal of solid waste and access to sanitation facilities. However, this relationship is subject to intervention by the Government and the community referred to as the study's intervening variables.

**Figure 2.1: Conceptual Framework**



Source: Researcher (2019)

## **CHAPTER THREE: RESEARCH METHODOLOGY**

This chapter outlines the research methodology adopted by the study. It presents the target population and sampling design; sources and methods of data collection; and method of data analysis. However, the chapter starts by presenting the relevant physical and human characteristics of the study area.

### **3.1 The Study Area**

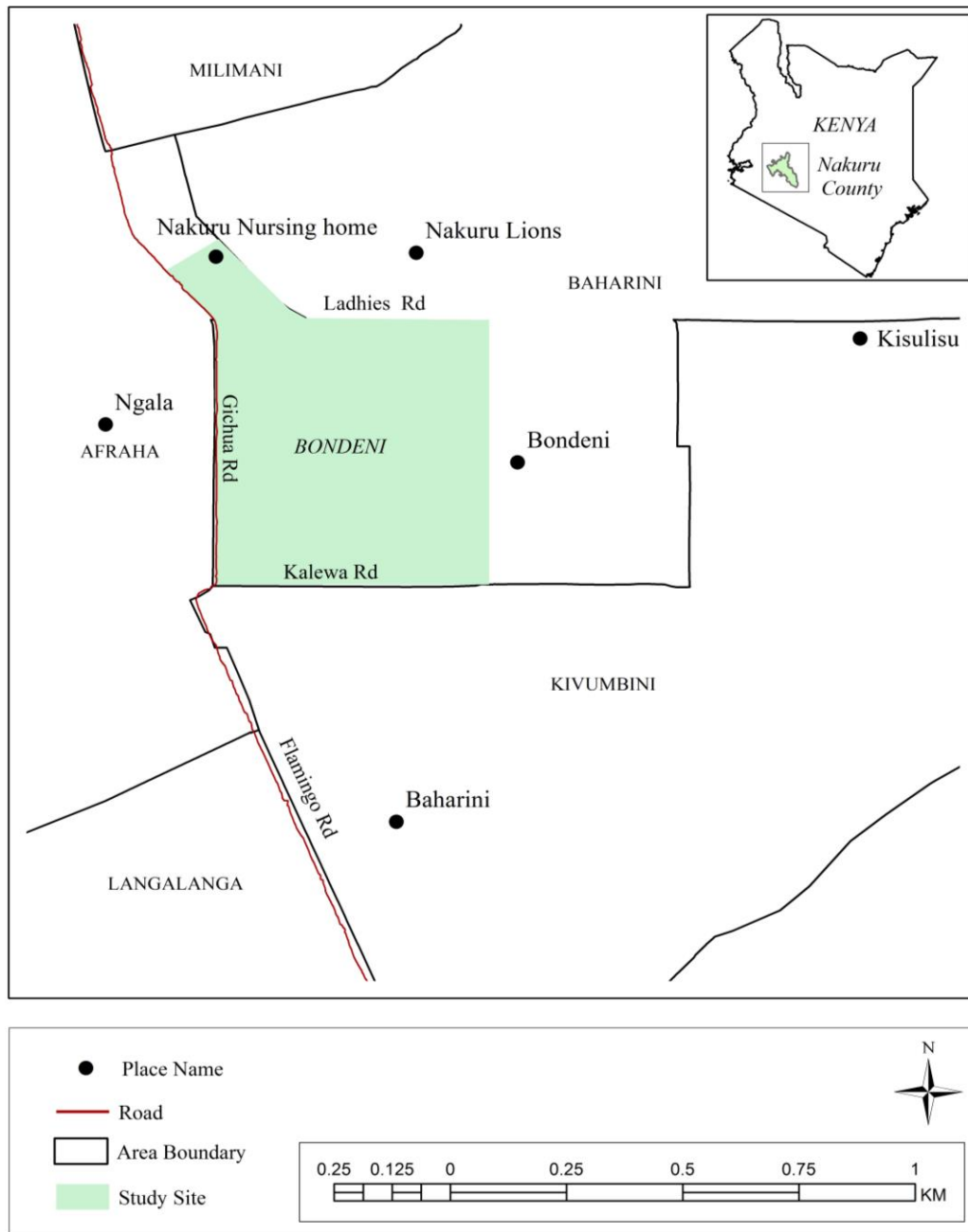
#### **3.1.1 Location of Study Area**

The study area is Bondeni estate of Nakuru town, Kenya (Figure 3.1). The study area is delimited by Lake Nakuru Game Park to the South, Flamingo Road to the South West, Mburu Gichua Road to the West, Shadrack Kimalel Road to the North and Kipkellion Road to the East. Bondeni, an informal settlement in Nakuru, emerged as early as 1914 by the Swahili speakers who first settled the area as they served the white settlers (Asians) as porters. They were later joined by other ethnic communities in 1960s and 1970s.

In terms of urban hierarchy, Nakuru town is the fourth largest city after Nairobi, Mombasa and Kisumu. The population of Nakuru has grown from 38,181 people in 1962 to 307,990 people in 2009 (GoK, 2010). Bondeni estate has a clear fabric representing housing that is colonial in origin that were essentially meant for bachelors but which today accommodates low income households. It accommodates more than half the council rental units and borders the environmentally sensitive Lake Nakuru.

The estate was started as early as 1914 by the Swahili people who were working as porters in the Asian farms. By 1960s and 1970s they were joined by other ethnic communities. Currently, the estate is densely populated with mud walled and tin roofed houses believed to be over 80 years old. Sanitation facilities such as sewerage piping system are poorly distributed and inadequate. Infrastructure such as roads, roadside drainage, toilets, sewer systems, streetlights, garbage collection facilities are in a poor state.

**Figure 3.1: Location of Study Area**



Source: Researcher (2019)

### 3.1.2 Physical Characteristics

Menengai Crater and Lake Nakuru form the key landmarks in Nakuru. Lake Nakuru is a shallow pan with saline water that is fed from several streams and surface runoff during the wet season. The major natural rivers in the catchment are Njoro River and Lamudiak River draining from the northern Mau escarpment, Makalia River and

Nderit River from the southern Mau escarpment and Ngosorr River from the Bahati Forest.

Nakuru is found within the floor of the Great Rift Valley. The town covers an area of 290 square kilometers, extending over the southern slope of the Menengai crater and bordering Lake Nakuru National Park on the south. Nakuru is located at an altitude of about 1,850 metres. Lake Nakuru has the lowest altitude of 1,750 metres above sea level while Menengai crater has the highest altitude of 2,100 metres above sea level.

In general the topography of the Nakuru area was formed by volcanic activities and faulting that created the Great Rift Valley. Thus volcanic soils are the dominant soil type. The climate of the area is influenced by altitude and physical features. Generally, the climate is warm and temperate. The area receives an annual rainfall ranging from 700mm to 1200mm or averagely 895mm. Temperatures are 17.5°C on average. Low temperatures experienced in the month of July and August while high temperatures are felt from January to March (Kenya, 2016).

### **3.1.3 Social and Economic Characteristics**

There are numerous typologies of housing in Nakuru, ranging from flats, bungalows, semi-detached, low housing and informal housing. The spatial structure of housing and settlements has evolved from racially and socio-economic based to ethnically based zones. High income estates are sparsely populated unlike low income estates that are densely populated and lacking essential services (Wambugu & Kyalo, 2014).

According to Nyasani (2009), solid waste management in Nakuru should be done by the local authority. Even then, the private sector is increasingly taking over the role. Sanitation facilities such as sewerage piping system are poorly distributed and inadequate. Infrastructure such as roads, roadside drainage, toilets, sewer systems, streetlights, garbage collection facilities are in a poor state. Lastly, lack of affordable housing has led to congestion and poor sanitation in the slum areas of the town.



## **3.2 Research Methodology**

### **3.2.1 Sampling Design**

The target population was the 6,148 households in the study area. The sample size was 74 households determined using the following formula:

$N = 1/C (Z \times S)^2$ , where:

$C = 5$  (tolerable margin of error)

$Z = 1.96$  (standard score for a given confidence level)

$S = 10$  (standard deviation of the pilot sample)

As such:

$$\begin{aligned} N &= 1/5 (1.96 \times 10)^2 \\ &= (19.6)^2 = 384.16/5 \\ &= 384.16/5 = 77 \end{aligned}$$

The sampled households were then determined using a simple random sampling procedure. A pilot study was done in Kaptembwo informal settlement of Nakuru town using 8 respondents (10% of the sample size). This helped in enhancing the validity and reliability of the survey instrument.

### **3.2.2 Sources and Methods of Data Collection**

The study used both primary and secondary data to achieve its specific objectives. The collection of primary data involved the use of a structured and semi-structure questionnaire and direct field observation by the researcher. The pre-coded questionnaire sought information on respondents' and household characteristics, housing conditions, sources of energy, drainage and sewerage, water supply, sanitation facilities, and residents' opinion on their housing and environmental conditions. The collection of secondary data involved reviewing and utilization of relevant literature and government publications.

### **3.2.3 Data Analysis**

The questionnaires from the field were checked for inconsistencies and reliability. Thereafter, the responses in the questionnaires were cleaned, coded and entered into

Statistical Package for Social Sciences (SPSS) software for analysis. The data was analyzed using descriptive statistics, largely the use of frequencies distributions.

#### **3.2.4 Ethical Issues**

The researcher sought research authorization from the National Commission for Science, Technology and Innovation (NACOSTI), from the County Government and from the area administration. The purpose of the study was first explained to the respondent in order to secure consent. Furthermore, information from the respondents was treated with confidentiality.

## CHAPTER FOUR: RESULTS AND DISCUSSION

This study is an assessment of the housing and environmental conditions of Bondeni informal settlement in Nakuru Town, Kenya. This chapter presents the study results based on the specific research objectives: 1) to establish the housing conditions in Bondeni informal settlement; 2) to examine the environmental conditions in Bondeni informal settlement; 3) to determine Bondeni residents' opinion on their housing and environmental conditions; and 4) to assess the potential effect of housing and environmental conditions on quality of life among Bondeni residents.

### 4.1 Characteristics Sampled Respondents

About one third of the respondents (62.2%) were household heads. The rest were spouse (24.3%), child (8.1%), friend (4.1%) or sister to the household head. Out of the 74 respondents, 52 (70.3%) were male, while 22 (29.7%) were female. Three quarters of the respondents (75.7%) were married, while the rest (24.3%) were single. The respondents were basically of youthful ages, most of them ranging from 19 to 47 years of age (Table 4.1).

**Table 4.1: Age of Respondents**

	<b>Frequency</b>	<b>Percentage</b>
19 to 28 years	15	20.3
29 to 37 years	16	21.6
38 to 47 years	36	48.6
Above 47 years	7	9.5
<b>Total</b>	<b>74</b>	<b>100</b>

Source: Fieldwork, 2018

This is an informal settlement with relatively high percentages of male and youthful population. Furthermore, most of the respondents had attained secondary (62.2%) and tertiary (16.2%) levels of education. The rest had primary level of education (17.6%), while three respondents indicated that they did not go school at all (Table 4.2).

**Table 4.2: Level of Education of Respondents**

	<b>Frequency</b>	<b>Percentage</b>
Not at all	3	4.1
Primary school level	13	17.6
Secondary school level	46	62.2
Tertiary / College level	12	16.2
<b>Total</b>	<b>74</b>	<b>100</b>

Source: Fieldwork, 2018

Despite the relatively higher levels of education, 58.1% of the respondents reported that they were unemployed (Table 4.3). Those in gainful employment were engaged in public and private sectors or had own business. This is an indication of high unemployment rates and engagement in informal sector activities characteristic of informal settlements with a high proportion of youthful population.

**Table 4.3: Employment Status of Respondents**

	<b>Frequency</b>	<b>Percentage</b>
Government	4	5.4
Private	8	10.8
Own business	15	20.3
Domestic worker	2	2.7
Unemployed	43	58.1
Student	2	2.7
<b>Total</b>	<b>74</b>	<b>100</b>

Source: Fieldwork, 2018

The average household monthly income ranged between Kenya Shillings 5,001 to 10,000 and below 5,000 (Table 4.4), while a large proportion of the rental units fetched between Kenya Shillings 501 and 2,000 per month (Table 4.5). The house rent in most cases is inclusive of water and lighting. Some of the respondents complained that the house rents are relatively high in relation to the housing conditions and the services offered, but they had no any other alternatives to better and affordable housing conditions.

**Table 4.4: Household Monthly Income**

	<b>Frequency</b>	<b>Percentage</b>
Less than 5,000	16	26.2
5001-10,000	34	55.7
10,001-15,000	13	17.6
15001-20,000	7	11.5
Above 20,000	4	6.6
<b>Total</b>	<b>74</b>	<b>100</b>

Source: Fieldwork, 2018

**Table 4.5: Monthly House Rent**

	<b>Frequency</b>	<b>Percentage</b>
Less than 500	3	5.2
501-1,000	6	10.3
1,001-1,500	13	22.4
1,501-2,000	17	29.3
2,001-2,500	4	6.9
2,501-3,000	6	10.3
Above 3,000	9	15.5
<b>Total</b>	<b>58</b>	<b>100</b>

Source: Fieldwork, 2018

## **4.2 Housing Conditions in Bondeni**

### **4.2.1 The Dwelling Units**

Most of the households (78.4%) lived in rented houses, while 21.6% lived in own house. More than half of the dwelling units (55.4%) had two rooms. Another one third (37.8%) were one roomed houses, while very few had three rooms (Table 4.6). The dwelling units had relatively high occupancy rates, a large proportion of them ranging from three to six members (Table 4.7).

**Table 4.6: Number of Rooms in the House**

	<b>Frequency</b>	<b>Percentage</b>
One	28	37.8
Two	41	55.4
Three	5	6.8
<b>Total</b>	<b>74</b>	<b>100</b>

Source: Fieldwork, 2018

**Table 4.7: Number of Household Members**

	<b>Frequency</b>	<b>Percent</b>
1-2	16	21.6
3-4	10	13.5
5-6	34	46.0
7-8	11	14.9
9+	3	4.1
<b>Total</b>	<b>74</b>	<b>100</b>

Source: Fieldwork, 2018

#### **4.2.2 Main Source of Cooking Energy**

Bondeni households use firewood, charcoal, kerosene and gas as the main sources of energy for cooking. However, more than half of the households (64.9%) depend on charcoal as their main source of cooking energy (Table 4.8).

**Table 4.8: Main Source of Cooking Energy**

	<b>Frequency</b>	<b>Percentage</b>
Firewood	5	6.8
Charcoal	48	64.9
Kerosene	8	10.8
Gas	13	17.6
<b>Total</b>	<b>74</b>	<b>100</b>

Source: Fieldwork, 2018

This is followed by the use of gas (17.6%), use of kerosene (10.8%) and use of firewood (6.8%). Whereas no household used electricity for cooking, all of them used electricity for lighting. Numerous charcoal stores were noted across the settlement, which support the high demand for charcoal in the area (see Plate 1). Furthermore, charcoal is relatively cheap, faster in cooking, readily available, and more often used for warming the house during the cold season.

**Plate 1: Selling of Charcoal**



Source: Fieldwork, 2018

#### **4.2.3 Main Source of Drinking Water**

There are two main sources of drinking water in Bondeni: Yard tap (51.4% of the households) and water kiosk (48.6% of the households). Further probing revealed that water in the settlement is largely supplied by Nakuru Water, Sewerage and Sanitation Company (NAWASSCO) and therefore largely safe for drinking. However, water scarcity is prevalent in the area and in such occasions the source of water sold from water kiosks is not always known. During the scarcity periods, women walk long distances to get water and take more time fetching water.

### **4.3 Environmental Conditions in Bondeni**

#### **4.3.1 Disposal of Liquid Waste**

More than half of the households (58.1%) acknowledged that they had challenges disposing liquid wastes. As a result, the main liquid waste disposal methods were open drains (63.5% of the households) and public sewer (36.5% of the households). The open drains are more often than not inadequate hand-dug channels, with lots of solid wastes that keep stagnant water for many days and contribute to frequent flooding in the settlement during rainy seasons (see Plate 2). In addition, the sewer system often blocks, leaks, bursts and is not properly maintained.

**Plate 2: Poorly Maintained Drain**



Source: Fieldwork, 2018

#### **4.3.2 Disposal of Solid Waste**

More than half of the households (59.7%) acknowledged that they had challenges disposing solid wastes. As such, eight out of every ten households (83.7%) dumped their solid wastes in the open (Table 4.9 and Plate 3). The rest of the households burnt or composted their solid wastes, with only three households acknowledging that their solid wastes are collected by the County Government of Nakuru.

According to some of the respondents, the main challenges associated with dumping of solid wastes include irregular collection by the County Government, air pollution,



bad smell, regular blockage of drains, cases of human waste disposal in open drains, and the fact that the wastes attracted houseflies and rats.

**Table 4.9: Methods of Solid Waste Disposal**

	Frequency	Percentage
Burning	3	4.1
Composting	6	8.1
Collected by County Government	3	4.1
Dumping	62	83.7
<b>Total</b>	<b>74</b>	<b>100</b>

Source: Fieldwork, 2018

**Plate 3: Open Dump Site**



Source: Fieldwork, 2018

#### **4.3.3 Access to Sanitation Facility**

Most of the households had access to shared flush toilets (Table 4.10). That is, households shared flush toilets that were constructed outside the main dwelling units. This could imply that 10 or more people shared a toilet. Only three households had an in house flush toilet. Another three households use ordinary pit latrine. A closer analysis of the shared flush toilets revealed that most of them were actually not

functional and as such the users “poured” water after use, instead of “flushing”. Furthermore, the sanitation situation of the shared toilets becomes worse when there is no water in the settlement.

**Table 4.10: Type of Sanitation Facility**

	<b>Frequency</b>	<b>Percentage</b>
Household flush toilet	6	8.2
Shared flush toilet	65	87.7
Ordinary pit latrine	3	4.1
<b>Total</b>	<b>74</b>	<b>100</b>

Source: Fieldwork, 2018

In fact, more than half of the respondents (56.8%) using shared flush toilets reported that they had no access to water “most of the time”. In addition, 76.8% of the respondents acknowledged that they face challenges using the shared sanitation facilities (see Plate 4). These challenges include lack of water, lack of cleanliness, congestion, misuse and frequent blockages. On the other hand, 66.2% of the respondents reported that the sanitation facilities in the area were poor.

**Plate 4: Communal Toilets**



Source: Fieldwork, 2018

#### 4.4 Opinion on Housing and Environmental Conditions

Table 4.11 gives a summary of Bondeni residents' opinion on their housing and environmental conditions. Generally, most of the housing and environmental conditions have been rated poorly with more than half of the respondents, except for water supply and sewer system. About three quarters of the respondents (70.3%) reported that the *dwelling units* in the settlement were of poor quality, largely because of their conditions and provision of other services, as well being smaller in relation to the household members. About two thirds of the respondents (62.2%) reported that their *sources of cooking energy* were poor, largely because they caused pollution, are not environmentally friendly and that they can cause diseases.

**Table 4.11: Opinion on Housing and Environmental Conditions**

	Poor		Satisfactory		Good	
	n	%	n	%	n	%
Dwelling unit	52	70.3	0	0	22	29.7
Cooking energy	46	62.2	10	13.5	18	24.3
Water supply	17	23.0	6	8.1	51	68.9
Drainage	48	64.9	6	8.1	20	27.0
Sewer system	30	40.5	4	5.4	40	54.1
Solid waste management	51	68.9	10	13.5	13	17.6
Sanitation facilities	49	66.2	16	21.6	9	12.2

Source: Fieldwork, 2018

The opinion towards *water supply* was much better as only 23% of the respondents reported that water supply was poor in the settlement, largely because of its frequent scarcity, unpredictability and unavailability. However, more than half of the respondents (64.9%) were of the opinion that the *drainage system* in the settlement was poor, while 40.5% were not satisfied with the *sewer system*. The drains are always blocked, causing flooding during rainy season and pools of stagnant water, while sewer system often blocks, leaks, bursts and is not properly maintained.

Given that dumping is a common daily practice in the settlement, and again due to lack of exposure to other alternatives, the large majority of the respondents (68.9%) were of the opinion that the current *solid waste disposal method* was poor. Lastly, 66.2% of the respondents reported that the *sanitation facilities* in the settlement were poor, largely due to lack of water, lack of cleanliness, congestion, misuse, and frequent blockages.

#### **4.5 Housing and Environmental Conditions: Potential Effects to Quality of Life**

According to Zainal et al (2012), there is a small but significant positive relationship between housing conditions, safety, social support and health. This provides empirical evidence that there is a relationship between housing conditions and quality of life. In addition, WHO (2010) shows that unhygienic condition in informal settlements leads to dangerous diseases such as diarrhoea, dysentery and cholera just to mention but a few.

The respondents were asked if any member of the household had experienced a predetermined listed number of common diseases in the last three months of the research. These were diarrhea, vomiting, fever and coughing. Half of the households (52.7%) experienced coughing, 21.6% experienced diarrhea, 21.6% experienced fever, while incidences of vomiting were very few (Table 4.12). Children aged 5 years and below are more likely to be affected by these diseases, as much as they also affect the adult members of the household (Table 4.13).

**Table 4.12: Experience of Common Diseases**

	<b>Frequency</b>	<b>Percentage</b>
Diarrhea	16	21.6
Vomiting	3	4.1
Fever	16	21.6
Coughing	39	52.7
<b>Total</b>	<b>74</b>	<b>100</b>

Source: Fieldwork, 2018

**Table 4.13: Age of Affected Household Member**

	<b>Frequency</b>	<b>Percent</b>
Below 5 years	23	31.1
6 to 18 years	12	16.2
19 to 37 years	18	24.3
38 to 47 years	13	17.6
Above 47 years	8	10.8
<b>Total</b>	<b>74</b>	<b>100</b>

Source: Fieldwork, 2018

Thirty one percent of household members affected were aged 5 years and below, 24.3% were between 19 to 37 years, 17.6% were between 38 to 47 years, 16.2% were between 6 to 18 years, and 10.8% were above 57 years. Children interact more with their physical environment and as such are more vulnerable to diseases caused by unhealthy environments. Consequently, child health is one of the most poignant indicators of quality of life among the urban poor. Surprisingly, 89.1% of the households never sought or received any medication from a health facility. The reasons were lack of money and lack of time.

Mutisya & Yarime (2011) found that the average household size in Kibera is seven, living in a structure 12ft by 12ft and costing approximately US\$15 (Ksh. 1500) per month. On the other hand, Antova et al (2008) identified a strong relationship between crowded living conditions and asthma. Likewise, Kanani (2014) established that despite the minimum acceptable accommodation standards for a household being two rooms with a cooking area, a toilet and a bathroom, many households in poor neighbourhoods live in single rooms. Acceptable housing in addition should provide open spaces, support facilities and physical infrastructure.

High usage of charcoal may lead to environmental degradation, increase in greenhouse gases, indoor pollution, as well as respiratory diseases. Cooking with solid fuels in a poorly ventilated environment contaminates the air with poisonous particles.

The respondents were asked to indicate whether or not they were aware of any dangers sources of energy used by them, may pose on their health. Over half of the respondents (56.8%) were not aware, while the rest (43.2%) were aware. On the other hand, most of the respondents (72.2%) were aware about the dangers of poor solid waste management (Table 4.14).

**Table 4.14: Awareness of Dangers of Poor Solid Waste Disposal**

	<b>Frequency</b>	<b>Percentage</b>
Less Extent	5	6.9
Not Aware	15	20.8
Large Extent	52	72.2
<b>Total</b>	<b>72</b>	<b>100</b>

Source: Fieldwork, 2018

## **CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS**

This chapter presents the summary of findings, conclusion and recommendations based on the results of the three specific research objectives: 1) to establish the housing conditions in Bondeni informal settlement; 2) to examine the environmental conditions in Bondeni informal settlement; 3) to determine Bondeni residents' opinion on their housing and environmental conditions; and 4) to assess the potential effect of housing and environmental conditions on quality of life among Bondeni residents.

### **5.1 Summary of Findings**

#### **5.1.1 Housing Conditions**

The findings reveal that most of the Bondeni residents are tenants (78.4%), while (21.6%) live in their own houses. The dwelling units were either two-roomed or single-roomed houses with high occupancy rates of three to six members. Kerosene, gas, firewood and charcoal were the sources of cooking energy used by most residents of Bondeni. Charcoal was the main source of cooking energy (64.9%) because it is cheap and easily available. The two main sources of drinking water were water yard and water kiosk with (51.4%) and (48.6%), respectively. Generally, water in the estate is safe for drinking since it is supplied by Nakuru Water, Sewerage and Sanitation Company (NAWASSCO).

#### **5.1.2 Environmental Conditions**

To examine environmental conditions in Bondeni informal settlement the study focused on liquid waste disposal, solid waste disposal and type of sanitation facilities. From the findings, 63.5% of the households dispose their liquid waste in open drains, which leads to blockage of drainage and attracting mosquitoes and houseflies. More than half of the households (58.1%) acknowledged that they face challenges in liquid waste disposal. Most households (83.7%) dispose their solid waste in open places, while the rest burn their waste. Most of the flush toilets were shared by more than ten people and had flushes that were not functional. Instead, they pour water after use. As such, the conditions of these sanitation facilities become worse during periods of water scarcity.

### **5.1.3 Opinion on Housing and Environmental Conditions**

Housing and environmental conditions has been rated poor with a majority (70.3%) reporting that their dwelling units were crowded and lacked adequate water during water scarcity. The residents walk long distances to look for this precious commodity, forcing them to make long queues and sometimes go back with empty buckets. Most households (64.9%) felt that the drainage system in the settlement is poor while 40.5% were not satisfied with the sewer system. Lack of enough water and congestion were the main issues affecting the use of the sanitation facilities.

### **5.1.4 Potential Effect to Quality of Life**

Housing and environmental conditions in Bondeni informal settlement are generally poor and this has greatly contributed to the spread of water-borne diseases such as diarrhoea (21.6%), vomiting (4.1%) and fever (21.6%). The residents also indicated that they experienced infectious diseases such as coughing (52.7%) likely due to crowded living conditions and pollution from sources of energy they use in their dwelling units. Child health being one of the poignant indicator of quality of life, under five were the most people affected by these diseases because they interact more with the physical environment.

## **5.2 Conclusion**

The study concludes that housing and environmental conditions was considered critical in determining the quality of life. Thus, it is clear that with the occupancy rates, sources of drinking water, and sources of energy, health related quality of life was compromised. As such, there is a positive relationship between housing and environmental conditions and health. The environment conditions in the settlement could attract diseases such as cholera, typhoid, dysentery, malaria, bilharzias, worms, eye and skin infections due to inadequate sanitation. Generally housing and environmental conditions in Bondeni is poor. The dwelling units are overcrowded and lack enough and efficient services such as garbage collection, sanitation facilities and drainage posing a threat to human health and affects the quality of life of the residents.



### **5.3 Recommendations**

#### **5.3.1 Policy Recommendations**

The citizenry should be educated on their responsibilities for a clean the environment. For example, the Constitution of Kenya, 2010 gives all citizens the responsibility of ensuring a clean and sustainable environment even as the Bill of Rights makes it their right to live in that kind of environment.

The study identified poor environmental conditions as one of the greatest problems in the study area. Due to poor liquid waste disposal, solid waste disposal and lack of enough sanitation facilities, (in terms of number and quality) this poses a great public health risk. This study recommends the need to give this problem a top priority. In general, more attention should be given to housing and environmental conditions so as to decrease environmental diseases. This is quite in line with the basic need approach.

The County Government should not only rely on revenue collection but should go further and put in place systems that will ensure efficient, accountable and transparent use of the available resources.

#### **5.3.2 Future Researchers**

The researcher suggests that there is need to compare housing and environmental conditions based on gender. There is also need to establish housing strategies that can be adopted to improve quality of life. There is also need to evaluate policies that are geared towards a cleaner environment and good housing conditions.

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**APPENDIX: HOUSEHOLD QUESTIONNAIRE**

- 1a. Are you the household head? (1) Yes (2) No
- b. If your answer is No, what is the relationship with household head?
- 2a. Is this your own house or rented?
- b. How many rooms are there in this house?
- 3. What is the average household income per month from all sources?

4. Please provide the following information

Hh members	Age (in complete years)	Religion (1) christian (2) muslim (3) others (specify)	Gender (1) male (2) female	Level of education (1) pri (2) sec (3) tertiary (4) no school at all	Employment (1) government (2) private (3) own business (4) domestic worker (5) unemployed (6) student	Marital status (1) married (2) single (3) divorced (4) widow/widower

5a. Which is the main source of energy you use for cooking? (1) firewood (2) charcoal (3) kerosene (4) electricity (5) solar panel (6) others (specify)

b. Explain why

6a. Which is the main source of energy you use for lighting? (1) firewood (2) charcoal (3) kerosene (4) electricity (5) solar panel (6) others (specify)

b. Explain why

7a. Which is the main source of energy you use for heating water? (1) firewood (2) charcoal (3) kerosene (4) electricity (5) solar panel (6) others (specify)

b. Explain why

8a. Are you aware of any dangers sources of energy may pose on your health? (1) Yes  
(2) No

b. If yes, explain the dangers

9. At what level can you rate the effects of sources of energy used in your household on your general wellbeing? (1) Good (2) Poor

10a .Over the last 3 months has anyone experienced any of the following conditions?  
(1) mucus like feaces (2) diarrhea (3) vomiting (4) blood spots on feaces (5) body rashes (6) fever (7) skin rashes (8) coughing (9) headache (10) pneumonia (11) irritating eyes

b. If yes, what is the age of the household member(s)

c. If yes, did the member receive medication from health facility? (1) Yes (2) No

d. If he/ she didn't receive explain why

11a. How do you dispose liquid waste in your household? (1) septic tank (2) sewerage  
(3) open drainage

Do you face any problem in disposing liquid wastes? (1) Yes (2) No

If your answer is yes, state the problem(s)

How best do you think the problem can be solved?

12a. Where do you get drinking water from? (1) yard tap (2) water kiosk (2) delivery service (3) well (4) rivers (5) others (specify)

b. How far do you walk to fetch water?

13. Are the streets paved in your area of residence? (1) Yes (2) No

15a. How do you dispose solid wastes generated from your household? (1) burning in open space (2) throwing in open space (3) dumpsites (4) throwing in open drainage (5) others (specify)

Do you face any challenges in disposing solid wastes? (1) Yes (2) No



16. What is the current situation of solid waste disposal? (1) very good (2) good (3) poor (4) very poor.
17. To what extent are you aware about the dangers of solid waste disposal? (1) large extent (2) less extent (3) not aware
18. What problems do you experience from waste disposal?
19. At what level can you rate the effects of drainage in your area of residence on your general wellbeing? (1) Good (2) Poor
- 19a. What type of sanitation facility do you use at home? (1) household flush toilet (2) shared water pour toilet (3) ordinary pit latrine
- b. If your answer was shared water pour toilet, on average how many people share it?
- c. If it is a water pour toilet do you have access to water? (1) yes (2) No
- 20a. If your answer was pit latrine, On average how many people share same pit latrine?
- b. How far is your pit latrine located from your household?
- 21a. Do you face any challenges in using the sanitation facility? (1) yes (2) No
- b. If your answer is yes, state those challenges?
- c. How best do you think these challenges can be solved?
22. Has anybody in your household complained of any of the following conditions? (1) diarrhea (2) abdominal pain (3) vomiting (4) fever (5) blood in urine
23. Where do you dispose solid wastes from your household? (1) sewer (2) open drainage (3) open ground (4) river (2) dumpsite
24. At what level can you rate the effects of sanitation facilities in your area of residence on your general wellbeing? (1) Good (2) Poor
25. What is your own opinion on the current state of the following services considering their effect on the environment?

**THANK YOU FOR YOUR CO-OPERATION**