

**ACCESSIBILITY OF ESSENTIAL MEDICINES FOR NON-COMMUNICABLE  
DISEASES IN A DEVOLVED SYSTEM OF GOVERNMENT IN TRANS NZOIA  
COUNTY, KENYA.**

**Lucy Lasoi Saiyoki**

**A thesis submitted in partial fulfillment of the requirements of the award for the  
degree of Master of Science in Public Health of the Masinde Muliro University of  
Science and Technology**

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## DECLARATION

This thesis is my original work prepared with no other than the indicated sources and support and has not been presented elsewhere for a degree or any other award.

Lucy Lasoi Saiyoki

Signature \_\_\_\_\_

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Date \_\_\_\_\_

## CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance of Masinde Muliro University of Science and Technology a thesis entitled '**Accessibility of essential medicines for non-communicable diseases in a devolved system of government in Trans Nzoia County.**'

Signature \_\_\_\_\_

Date \_\_\_\_\_

**Dr. Rose Olayo, Ph.D**

Senior Lecturer,

Department of Public Health,

Masinde Muliro University of Science and Technology.

Signature \_\_\_\_\_

Date \_\_\_\_\_

**Prof. James A. Oloo,**

Professor of Epidemiology,

School of Medicine,

Masinde Muliro University of Science and Technology.

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## **DEDICATION**

This thesis is dedicated to my children William Mugwang'a, Ella Alusa and my husband Dr. Tiberius Adeya for their continued support throughout this work.

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## ABSTRACT

Access to medicines is a multidimensional concept said to exist when patients have continuous availability of essential medicines at affordable prices and within a physical location that is accessible. With devolution of health services, access to essential medicines, including those for non-communicable disease is meant to improve. The study sought to determine the accessibility to essential medicines for the four major non-communicable diseases in Trans-Nzoia County. The study was conducted in five hospitals within Trans Nzoia County using both qualitative and quantitative methods. Patients and key personnel within the health facilities were interviewed. Secondary documents from the health facility were also reviewed. The design was a descriptive cross sectional study carried out for three months among outpatients with non-communicable diseases. The sample size used was 320 participants attending the medical outpatient clinic and 25 key personnel. The study participants were selected by use of simple random sampling. Data obtained was analyzed using mean, percentages, standard deviations as well as Chi and odds ratio. The study found that most of the non-communicable diseases medicines were unavailable at the health facilities at 23%. Medicines for management of diabetes were found to be most available in all the hospitals at 80%. Stock out rate for essential medicines for non-communicable diseases was found to be high at 202 days per year, which was attributed to poor health care financing by the county government of Trans Nzoia. Medicines for cancer treatment were found to have the highest stock out days at 334 days per year. The study found the essential medicines for non-communicable diseases to be affordable based on the minimum daily wage calculation at 0.309 days' wages. Affordability calculated was based on individual drugs and not for a complete therapy. However, 78% of the participants reported that the medicines were not affordable. Medicines for management of chronic obstructive pulmonary disease were found to be most costly with affordability of 0.449 days' wages. Additionally, the study showed that health facilities where participants received essential medicines for non-communicable diseases were geographically accessible with most participants at 92% using 1 hour or less to get to the facility. However, with the use of daily wages the affordability of the transport means was found to be 0.52 days' wages hence not accessible. There was a significant association between the proportion of the prescribed drugs that the participants had received and their health status,  $p=0.03$ . With an epidemiological change in the low and medium income countries including Kenya from communicable diseases to non-communicable diseases, there is need for renewed focus on access to essential medicines for these conditions as reflected by the formation of division of non-communicable disease in the Ministry of Health. Based on the study findings, there is need to increase healthcare funding by the county government for purchase of essential medicines for non-communicable diseases. This will greatly reduce stock out rates thereby increasing availability.

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## **ABBREVIATIONS AND ACRONYMS**

<b>COPDs</b>	Chronic Obstructive Pulmonary Diseases
<b>CVDs</b>	Cardiovascular Diseases
<b>EDL</b>	Essential drug list
<b>EM</b>	Essential medicine
<b>EMMS</b>	Essential Medicines and Medical Supplies
<b>FIF</b>	Facility Improvement Fund
<b>GDP</b>	Gross domestic product
<b>GOK</b>	Government of Kenya
<b>KEML</b>	Kenya Essential Medicine List
<b>KEMSA</b>	Kenya Medical Supplies Authority
<b>LMIC</b>	Low and Medium Income Countries
<b>LPO</b>	Local Purchase Order
<b>MEDS</b>	Mission for Essential Medicines Supply
<b>MOMS</b>	Ministry of Medical Services
<b>MOPHS</b>	Ministry of Public Health and Sanitation
<b>NCDs</b>	Non-Communicable Diseases
<b>OOPE</b>	Out of Pocket Expenditure

<b>SDG</b>	Sustainable Development Goals
<b>SPSS</b>	Statistical Software for Social Sciences
<b>WHO</b>	World Health Organization

## **OPERATIONAL DEFINITION OF TERMS**

70-70 paradox	70% of cost incurred on healthcare services is directly paid by patients of which 70% accounts for expenditure on medicines.
Accessibility	This is defined as having medicines continuously available and affordable at health facilities that are within an hour's walk from homes of the patients.
Affordability	This is the relationship between the price of a service/good and the willingness and ability of the user to pay for the service based on their financial income and cost of the medicine.
Availability	This is the opportunity to access the health services required when needed.at a point in time at the health facility visited.
Burden of disease	This is defined as the economic implications of the disease in question through morbidities, disability and mortalities.
Catastrophic expenditure	This refers to expenditure on medicine that is so high such that other basic needs remain unfulfilled.
Drawing rights	This is the allocation for each health facility for essential medicines and medical supplies purchase.
Gross domestic product	The measure of all goods and services produced within a country in one year expressed in monetary terms.
Health status	The condition on the day of hospital visit as reported by the participant

Lead time	Length of time between placing an order and when the order is delivered and available to the end user.
Morbidity	State of being afflicted by disease or poor health.
Mortality	State of being subject to death
Physical accessibility	Geographical accessibility is defined as the distance required to travel or the time required to travel between the patients place of residence and the point of service delivery
Pull system	A system of procuring medicines whereby the user department determines the categories and quantities of medicines to be supplied with.
Push system	Also called kit system, is a system of procuring essential medicines in which the user department passively receives predetermined fixed selection of supplies in defined quantities irrespective of its needs.

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background information to the study

Accessibility to medicines refers to a state of continuous availability of essential medicines (EM) at affordable prices and within a geographical setting that is reachable according to Ministry of Health (MOH, 2009). It is estimated that a third of the world population has no access to essential medicines including medicines meant for non-communicable diseases (NCDs) with the situation being worse in low and middle-income countries (LMIC) where it is estimated that half of the total population has poor access to essential medicines according to World Health Organization (WHO, 2004).

Access to medicines may be affected by many factors such unavailability, unaffordable prices, poor health financing and poor supply chain practices (Sangeeta, 2015). A study done by Cameron *et al*,2010 targeting essential medicines for non-communicable diseases revealed the mean availability to be 35 % in public health sector in 30 low and medium income countries while another study conducted in Tanzania in 2012-2013 showed below optimal availability of essential medicines for NCDs (Robertson, 2015). In Kenya, the mean availability of essential medicines for non-communicable diseases essential medicines according to the Service Availability and Readiness Assessment Mapping report(SARAM) was estimated to be 25% (MOH, 2014)

The non-communicable diseases burden reduction is highly dependent on equitable access to essential medicines. Estimates show that appropriate use of essential medicines

has the potential to reduce non-communicable diseases burden by 80% (WHO, 2013). Therefore, access to essential medicines for non-communicable diseases is critical in both population and individual based strategies. However, the increasing prevalence and burden of NCDs results in many patients being unable to receive the required prompt treatment and care (Gowshall, 2018). Universal access to healthcare is heavily dependent on availability of quality assured medicines and health products that are affordable to the end user (Robertson, 2015).

Poor supply of essential medicines or simply put unavailability of essential medicines in public health facilities has a direct effect on mortality and morbidity. This is because public health facilities serve the larger population that cannot afford private health care (Muiruri, 2017). Essential medicines are meant to be available to all in functioning health system at the right dosage form, good quality, adequate amounts and affordable prices. Unavailability of essential medicines lowers the credibility of a public health system. Accessibility to these essential medicines of which availability is one of the major indicator has a close relationship to health system and its adequate utilization (Sakthivel, 2005).

In most developing countries a big proportion of the household health related expenditure goes to the purchase of essential medicine, mainly done out of pocket. This leaves household and individuals exposed to poverty effects of purchase of essential medicines for non-communicable diseases with the acute phase of management of NCDs being costlier. This slowly pushes the families below the poverty level very early into the disease and this has led to popularization of the generic brands of essential medicines for

the non-communicable diseases (Sangeeta, 2015) .However, even with the availability of low-cost generic essential medicines for NCDs, these essential medicines are still unavailable and unaffordable in most low and medium income countries.

Globally, there has been greater emphasis on HIV/AIDS and other communicable diseases as evidenced by the multiplicity of donor and government funded programs that routinely conduct surveillance, immunization and other health promotion and curative strategies for these conditions (Malia, 2017).Non-communicable diseases are a growing source of morbidity and mortality and it is projected that its prevalence may exceed that of communicable diseases as the leading cause of mortality globally by the year 2030 (WHO, 2014, Setswe 2014).

According to the National Council for Population and Development report, June 2017, non-communicable diseases are the leading causes of death globally, killing more people each year than all other causes combined. Contrary to popular opinion, available data demonstrates that nearly 4 in 5 non-communicable diseases deaths occur in low and medium income countries (Gowshall, 2018). Much of the social and human impact caused each year by non-communicable diseases related deaths could be averted through well understood, cost effective and feasible interventions. Mortality reports indicate that 57 million deaths occurred globally in 2008, 36 million representing two thirds were attributed to NCDs (Sangeeta, 2015).

Like other developing countries Kenya is facing a double burden of communicable and non-communicable diseases. In Kenya non-communicable diseases account for more than 50% of total hospital admissions and 55% of hospital deaths (MOH, 2015b). The national

non-communicable diseases prevention and control strategy 2015-2020, which correlated with global action plan for prevention and control of non-communicable diseases, aims to reduce the preventable prevalence of morbidity, disability and mortality due to NCDs through multi-sectoral collaboration at the national and county level through focus on all major non-communicable diseases including cancer, diabetes, cardiovascular diseases, chronic obstructive pulmonary diseases.(MOH, 2015a)

The World Health Organization strategy, renamed “best buys” provides policy directions and recommended interventions appropriate to national context in implementing measures towards achieving sustainable development goals (SDG) especially SDG 3 on good health and well-being. Top on the list of WHO health system best buys on countering non-communicable diseases is the use of multi drug therapy including glycemic control for diabetic patients, aspirin therapy for acute myocardial infarction, treatment of persistent asthma with inhaled corticosteroids and B<sub>2</sub> agonists (WHO, 2013)

In the Kenyan context, only 34% of facilities in the country can provide the Kenya essential package of health for non-communicable diseases defined services. This figure is higher for Trans Nzoia County, at 43% although the mean availability of tracer NCD essential medicines was 15% which is much lower than the national figure (MOH,2014). From daily activity registers, about 6000 patients were recruited in the diabetes and hypertension clinic at Kitale County Referral Hospital between the year 2014 and 2017.The prevalence of non-communicable diseases in Trans Nzoia County stands at 30% (MOH, 2015b).

In practice, devolution in Kenya was preceded by the adoption of a new constitution in 2010 that outlined a new structure of government consisting of a central government and forty-seven devolved units referred to as counties (Murkomen, 2012). The execution of health functions is outlined in the new constitution with the assignment of these functions between the central and county governments. Responsibility for health service delivery, promotion of primary health, county health facilities, pharmacies, crematoria, mortuary and ambulance services are assigned to county government while national referral hospitals, capacity building and formulation of policy is assigned to the central government (MOH., 2012). According to Murkomen, devolution was aimed at promoting access to health services throughout the country, addressing bureaucratic challenges in procurement of medical supplies and improving quality of health services (Murkomen, 2012).

Devolution is not unique to Kenya as there is an increase in devolution of healthcare systems in other countries like Ghana, Zambia, Philippines and Guatemala whereby the functions and activities sitting at the central government are getting decentralized over time (Bossert, 2002). The expectation is that devolved health system will improve accessibility and equity of services as well as promote accountability and transparency due to increased decision space (Muchomba, 2015).

## **1.2 Problem Statement**

The recent past has seen non communicable diseases like diabetes, chronic obstructive pulmonary diseases, cancers and cardiovascular diseases become an emerging public health pandemic with higher rates in developing countries (Gowshall, 2018).

The world health organization has projected that non communicable diseases will account for 80% of the global burden of disease by the year 2020 causing seven out of ten deaths in low and medium income countries, half of them being premature deaths below the age of 70 years (Abegunde, 2007). Global burden of non-communicable diseases is expected to increase by 17% in the next 10 years. In Africa especially sub Saharan Africa, it is estimated that non communicable diseases will increase by 27% (WHO,2004).

About 90% of chronic obstructive pulmonary diseases deaths, 80% of diabetes and cardiovascular deaths and 2/3 of cancer deaths occur in developing countries. Like other developing countries Kenya is facing a double burden of communicable and non-communicable diseases. In Kenya, non-communicable diseases accounts for more than 50% of total hospital admissions and 55% of hospital deaths (Republic of Kenya national non communicable diseases plan 2015-2020 (MOH, 2015a).

A household survey of 2015 done in five low and medium income countries including Kenya found out that 82% non-communicable disease patients in Kenya paid for their essential medicines out of their pockets (Subramanian, 2018).

Several studies have been carried out both in Kenya and other countries on the accessibility of essential medicines under devolved systems. The observation being that

devolution has increased the decision space for the management of essential medicines and medical supplies and its expected that better supply system should be observed (Tsofa, 2017).None of these studies has focused on accessibility of essential medicines for non-communicable diseases in Trans Nzoia County where the prevalence of non-communicable diseases is on the rise at 30% according to Trans Nzoia County integrated plan 2018

This study therefore focused on the accessibility of the essential medicines for non-communicable diseases in the devolved system at the county and sub county hospitals in Trans Nzoia County.

### **1.3 Objectives**

#### **1.3.1 Broad Objective**

To determine the accessibility of essential medicines for the non-communicable diseases in a devolved system of government in Trans Nzoia County

#### **1.3.2 Specific Objectives**

- i. To determine availability of essential medicines for non-communicable diseases in Trans Nzoia county.
- ii. To determine affordability of essential medicines for non-communicable diseases in Trans Nzoia county.
- iii. To determine physical accessibility of essential medicines for non-communicable diseases in Trans Nzoia county.

#### **1.4 Research questions**

- i. Are the essential medicines used for non-communicable diseases available in Trans Nzoia County?
- ii. Are the essential medicines used for non-communicable diseases affordable in Trans Nzoia County?
- iii. Are essential medicines used for non-communicable diseases physically accessible in Trans Nzoia County?

#### **1.5 Justification**

A study on accessibility of essential medicines for the non-communicable diseases in the devolved system of government has not been done in Kenya and particularly in Trans Nzoia County. In a study done by Mecca in 2016 on availability of essential medicines, she recommended for a study to be done on availability of essential medicines in a devolved health system.

Trans Nzoia County has been marked as a pilot study county for a World Bank program in tackling non-communicable diseases challenges in Kenya. Among the focal points of the non-communicable diseases pilot project are the cost of essential medicines, stock outs and inadequate availability of the essential medicines and medical supplies (WorldBank, 2018). The prevalence of non-communicable diseases is also on the rise at 30% according to the Trans Nzoia county integrated plan of 2018-2022.

Accessibility of essential medicines including those for non-communicable diseases is one of the key pillars in attaining one of the big four agendas on universal health coverage (UHC) and sustainable development goal 3 on good health and well being

### **1.6 Significance of the study**

The assessment report on accessibility of essential medicines for management of non-communicable diseases will be used to inform policy makers, financiers and consumers on the correct state of accessibility in terms of availability, affordability and physical access. This in turn will be used as a source of information in evaluating action plans towards 80% medicine availability and affordability target as set by the WHO (Robertson, 2015). It will also be used by policy enforcers in ascertaining to what extent the Kenya Essential Medicines List 2016 is being implemented

### **1.7 Limitation of the Study**

The study only considered patients who suffered from these non-communicable diseases and attended outpatient clinic during the period of study. The patients who had these non-communicable diseases but did not attend the medical outpatient clinic were not captured.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter focuses on the review of literature. It addresses the following areas, the burden of non-communicable diseases, devolution of health, accessibility of essential medicines and the existing relationships. It also identifies the existing gaps that the study filled and gives a summary that links to chapter three of the study.

#### **2.2 Burden of non-communicable diseases**

Globally, there has been greater emphasis on human immune deficiency virus (HIV) and acquired immune deficiency syndrome (AIDS) as well as other communicable diseases as evidenced by the multiplicity of donor and government funded programs that routinely conduct surveillance, immunization and other health promotion and curative strategies (Malia, 2017). This emphasis on communicable diseases has been dominant despite the fact that non-communicable diseases are a growing source of morbidity and mortality and it is projected that its prevalence may exceed that of communicable diseases as the leading cause of mortality globally by the year 2030 (Setswe, 2014). According to the national council for population and development report of June 2017, non-communicable diseases are the leading causes of death globally, killing more people each year than all other causes combined. Mortality reports indicate that 57 million deaths occurred globally in 2008, 36 million representing two thirds were due to NCDs. Over 80% of

deaths from non-communicable diseases is estimated to occur in low and medium countries (Abegunde, 2007).

Contrary to popular opinion, available data demonstrates that nearly 4 in 5 non-communicable diseases deaths occur in low and medium income countries About 30% of patients with non-communicable diseases in low- and medium-income countries are aged below 60 years which is a highly economically productive cohort compared to only 13% in high income countries. In sub Saharan Africa patients with non-communicable diseases die 10 years earlier than those in developed countries (WHO, 2014).

Non-communicable diseases share four common risk factors which are: harmful alcohol use, tobacco use, unhealthy diet and physical inactivity (Bertram2004; MOH 2015a). Every 1 in 5 deaths from non-communicable diseases in adults in Africa is caused by cancer. In the year 2004, more than half of the deaths in sub Saharan Africa were caused by infectious diseases and 25% by NCDs. It is projected that non-communicable diseases will cause >46% deaths in sub Saharan Africa by year 2030 (WHO, 2013).

The table 2.1 illustrates some demographic elements and their estimated figures in sub Saharan Africa

**Table 2.1: Demographic elements in Sub Saharan Africa**

<b>Data element</b>	<b>Value (as at 2006)</b>
Total population	749,269,486
Total deaths	11,661,836 (100%)
Deaths caused by Cancers	492,547 (4%)
Deaths due to Diabetes	174,041 (1%)
Deaths from Nutritional/endocrine diseases	68,677 (1%)
Deaths due to Neuropsychiatric diseases	130,078(1%)
Deaths caused by Cardiovascular diseases	1,232,261 (11%)
Deaths from Chronic respiratory diseases	314,184(4%)
Deaths from others NCDs	491,814(4%)

**Source:** (Mathers, 2006).

Like other developing countries Kenya is facing a double burden of communicable and non-communicable diseases. In Kenya non-communicable diseases account for more than 50% of total hospital admissions and 55% of hospital deaths (MOH, 2015b). Whereas cancer is the leading cause of death worldwide accounting to 13% mortality, it is

estimated to be the second cause of deaths in Kenya at 7% (KNBS,2015). The prevalence of diabetes in Kenya among adults is estimated to be 4.6% representing 750,000 people of whom 20,000 succumb to the disease annually. Mortality due to cardiovascular diseases in Kenya ranges from 6.1% to 8% (WHO, 2014) while autopsy studies suggest that more than 13% of cause specific deaths amongst adults could be due to cardiovascular diseases (Bloomfield, 2014). This is attributed to increased incidences of hypertension over the last 20 years. Chronic obstructive pulmonary diseases (COPD), which refers to lung diseases that cause limitation in lung airflow is often an undiagnosed yet life threatening lung disease that may progressively lead to death. Despite high prevalence in developed countries almost 90% of chronic obstructive pulmonary disease deaths occur in low and medium income countries (WHO, 2015).

Non-communicable diseases cause about 40% of annual deaths with only few people being able to access quality medical care. This situation is more severe in two counties of Busia and Trans Nzoia where poverty rate is high. Trans Nzoia has a poverty rate of over 50% (World Bank, 2018).

The national non-communicable diseases prevention and control strategy 2015-2020, which correlated with global action plan for prevention and control of non-communicable diseases, aims to reduce the preventable burden of morbidity, disability and mortality due to non-communicable diseases through multi-sector collaboration at the national and county level through focus on all major non-communicable diseases including cancer, diabetes, cardiovascular diseases, chronic obstructive pulmonary diseases (MOH, 2015a).The World Health Organization strategy, renamed “best buys” provides policy

directions and recommended interventions appropriate to national context in implementing measures towards achieving sustainable development goals (SDG) especially SDG 3 on good health and well-being. (WHO, 2013).

To help in the selection process, the WHO has developed a model essential drug list (EDL) which should be modified to meet each country's needs. Kenya has adopted its revised Kenya essential medicines list (KEMML) 2016 from the previous KEMML 2010 in which essential medicines used for management of non-communicable diseases are included (MOH, 2016).

Locally, data on the rate of stock out of essential medicines for management of non-communicable diseases is not available. However, studies have shown that generally, about 30% of the world population (1.3-2.1billion) has no access to essential medicines with 67 million people in Africa lacking access to these medicines (Zelam, 2013). A study in Kenya has shown that a public health facility has an average stock out of essential medicines for about 46 days annually. This can either be days in between supplies or consecutive days which can even extend up to 90 days consecutively as a result of frequent interruptions of the supply chain. This non-availability of essential medicines is cited as the most important barrier to quality healthcare services by consumers (MOH, 2009).

A study done in South Africa and Uganda show that the devolved form of government concentrated on procuring what was publicly visible and would gain them some political mileage such as ambulances and refurbishing hospitals as opposed to purchasing of essential medicines and medical supplies (EMMS) which would not give a big political

mileage (Klugman 2003, Jeppson 2000; Khalegian 2004). This also resonated to a study done in Kenya in Kilifi County where the county prioritized buying of ambulances in place of the much needed EMMS. The observation being that devolution has increased the decision space for the management of essential medicines and medical supplies and its expected that better supply system should be observed (Tsofa, 2017).

However some studies also indicate that centralized management of essential medicines and medical supplies gave better results in terms of better supply and economies of scale in procurement as well as better control of quality of essential medicines and medical supplies (Bossert, 2015).

### **2.3 Availability of Essential medicines for Non-Communicable Diseases**

Availability of essential medicines at health facilities is an important aspect of the health system performance (Marianne, 2012). Simply put as the presence of a drug at the health facility during the time of filling the prescription in hospital setting (MOH, 2015a). Universal access to healthcare is heavily dependent on availability of quality assured medicines and health products (Robertson, 2015). Poor supply of essential medicines or simply put unavailability of essential medicines in public health facilities has a direct effect on morbidity and mortality. This is because public health facilities serve the larger population that cannot afford private health care (Muiruri, 2017)

Essential medicines are meant to be available to all in functioning health system at the right dosage form, good quality, adequate amounts and affordable prices. Non availability of essential medicines lowers the credibility of a public health system (Sangeeta, 2015).

Accessibility to these essential medicines of which availability is one of the concepts has a close relationship to health system and its adequate utilization (Sakthivel, 2005). Despite the efforts to make essential medicines including medicines for non-communicable diseases available, the efforts can be undermined by several factors such as poor medicines supply and distribution system, low investment in health and high cost of medicines. According to SARAM report of 2013, the stocking of essential medicines for non-communicable diseases was very poor in Kenya public health facilities. Maternity homes and private hospitals were found to have better stocks of the non-communicable diseases essential medicines as compared to public health facilities (MOH, 2014). Out of all the about 12 tracer essential medicines for non-communicable diseases only aspirin was found to have a stocking level of 55%. The rest including metformin, a very important drug in combating diabetes mellitus was at 18%. The report also notes that in Trans Nzoia County, out of the 137 health facilities only 9% had metformin in stock at the time of the survey (MOH, 2014).

Most consumers use the availability of essential medicines as a key indicator of quality of services in a healthcare system (Robertson, 2015). Lack of the essential medicines or poor supply often leads to underutilization of the healthcare facilities. The readiness index for provision of non-communicable diseases services is 34%, which are the facilities that are ready to offer the services. This includes provision of essential medicines for non-communicable diseases (MOH, 2014) and the SARAM report raises concerns that generally products for management of non-communicable diseases were

not available (MOH, 2014). As stated earlier, availability of essential medicines and medical supplies is linked to order lead times, order rates and stock out time.

#### **2.4 Stock out of essential medicines for non-communicable diseases.**

Stock out is defined as a situation in which there are no commodities of a particular kind that are otherwise expected to be present. Stock out rate is an indicator that measures the number of days for which a particular item was out of stock at any given time in a defined period of time (Evaluation, 2018). This indicator can either be calculated separately for each product or it can be aggregated. The purpose of this indicator is to measure product availability/absence over a period of time and serves as a partial indicator of the overall ability of a facility to meet client's needs with a full range of products (Evaluation, 2018; Robertson 2015).

Essential medicines stock out is a well-known problem in the sub Saharan Africa whose negative effect on morbidity and mortality is known as well (WHO, 2014) On provision of essential medicines, there is no available data on the rate of stock out of essential medicines for management of non-communicable diseases but studies have shown that about 30% of the world population (1.3-2.1billion) has no access to essential medicines. About 67 million people in Africa lack access to essential medicines (WHO, 2014).

A study done in Kenya by the ministry of health in 2009 has shown that public health facilities lack essential medicines for about 46 days in a year. The study indicated that stock out levels were worsening as the stock out days stood at 25 days in 2003. This can

extend up to 90 consecutive days caused by the frequent interruptions of the supply chain (MOPHS, 2012).

Non-availability of essential medicines is cited as the most important barrier to quality healthcare services by consumers according to SARAM 2013. A survey conducted in 2012 on healthcare customer satisfaction, employee satisfaction work environment, less than 50% of the patients who visited public health facilities could get all the prescribed essential medicines, precisely 47% and more challenges remain to be experienced with devolution (Bossert, 2015). Many factors could contribute to stock outs including financing, road infrastructure, resource planning and distribution, procurement process, supply capacity and human resource. Amongst suggested solutions to stock outs include proper inventory management through visibility of stocks via small message service.

## **2.5 Affordability of Essential medicines for Non-Communicable Diseases**

About two billion people in the world live below the poverty line with poverty and non-communicable diseases being linked in many different pathways. Provision of good quality care to the poor is ethically enshrined but the weak health systems with inadequate health care financing leads to the poor not having access to the services or if accessible then they turn out to be substandard (World Bank, 2018).

With out of pocket expenditure in most low and medium income countries being unacceptably high the governments need to put more effort in transforming and regulating health systems for universal access and social protection. Respective ministries

of health are therefore tasked with a responsibility to ensure reduction of the ever rising healthcare costs to non-communicable diseases and their accompanied co-morbidities.

Most non communicable diseases affect the poor more heavily due to the catastrophic impact in their financial welfare, those of their families and government as well. This is due to the costs of treatment and the loss of potential years of the life productive years.

Micro economic approach tries to put the impact of the cost of illness on the household income. A study of 3 low medium income countries put the estimated costs to be 10% of the household income which can have a catastrophic effect on the income of poor households. Studies show that the cost of illness of non-communicable diseases which include the cost of essential medicines for non-communicable diseases to be between 0.02 %-6.67 % of the annual gross domestic product in developed countries. In developing countries, the cost of illness of diabetes alone is estimated to be between 1.8%-5.9% in Venezuela and Barbados (WHO, 2013).

By the year 2014 only 20% of the Kenyan population had national hospital insurance fund (NHIF) coverage despite the ongoing efforts by the government to increase its coverage. Poor families and especially those living in the rural areas are most likely not to have insurance and this greatly affects access to essential medicines for non-communicable disease (MOH, 2015a).

Among the efforts that have been put to increase economic access to the poor in the lower and medium income countries is the Novartis Access which is a social business initiative designed to make available and affordable a portfolio of 15 originator brands of

medicines for cardiovascular diseases, breast cancer, chronic obstructive pulmonary diseases and diabetes. These medicines in Kenya are supplied through the mission for essential medical supplies (MEDS) which is a faith based organization that distributes medicines at very subsidized prices (Kirwa, 2017).

Many factors have been put across as hindrances to access to essential medicines including those for non-communicable diseases. Amongst them are the unaffordable prices of medicines. This is worst in the poorest countries in Asia and Africa where 50% of the population lack access to these essential medicines (WHO, 2005).

How best essential medicines are available in a country is dependent on the country's budget to health. The World Health Organization projects that about 25% of the world population consumes about 90% of all the pharmaceutical produced. Most developing countries including Kenya allocate about 25-70% of their health budget to procurement of medicines. However, more medicines can be obtained with a smaller budget by a careful procurement process including utilization of the cheaper generics (WHO, 2008).

Costing for public healthcare is funded from government allocation, donor funding and out of pocket expenditure (OOPE) by patients. The government operates 41% of the total health facilities implying that almost half of the Kenyan population receives healthcare from government facilities (Wamai, 2009). In this regard healthcare financing becomes a very crucial component in ensuring affordability of essential medicines. In the financial year 2017/2018, the government of Kenya allocated 4.6% of the gross domestic product (GDP) to be spent on health which is below the recommended 15% of GDP (Mugo, 2018).The Abuja declaration requires that for a functional healthcare system in any

country then the country must allocate a minimum of 15% of its gross domestic product to health .Failure to this has led to the patients having to chip in for this inefficiency by incurring out of pocket expenditure to pay for their medicines (Subramanian, 2018). Medicines account for a high proportion of health spending in most low and medium income countries at about between 20 % and 60% (Cameroon, 2009) with 50-90% of this being out of pocket expenditure. In Kenya out of pocket expenditure on essential medicines currently stands at more than 29% of total healthcare cost and could be the greatest impediment to uptake of health care services (Munge, 2014).The consequence of out of pocket expenditure is that when prices for medicines are high, patients especially those from poor backgrounds suffer the most by either foregoing the treatment or incurring catastrophic expenditure (Niens, 2013).When patients opt to forego treatment then the prognosis of their disease becomes poorer as more complications set in bringing the cost of treatment even higher.. Even though the cost of medicines is just a fraction of the total cost of treating an illness, it is clear that the high cost of medicines has contributed to the 70-70 paradox leading to catastrophic effect on the poor population (Zelam 2013; Kiran 2018).This catastrophic spending then pushes the population further into poverty as people forego more and more of the basic wants to cater for their medicines needs.

The high unemployment level of 9.8% has been put across as another impendent to essential medicines access coupled with the poor wages paid to the employees in the informal sector who form the bulk of the employed population (World Bank, 2018). This

therefore means that however low the prices of essential medicines are put it will still be difficult to be economically accessible to a majority of the population.

The poverty level of Trans Nzoia county has been put at 50% by the world bank (World Bank, 2018) implying that about a half of the population in this county lives at less than one \$ dollar in a day. This further worsens their economic access to these medicines as their purchasing power is highly compromised.

## **2.6 Physical accessibility to Essential medicines for Non-Communicable Diseases**

Physical accessibility is defined as the distance required to travel or the time required to travel from the patients place of residence to the point of service delivery (Hanson, 2003) Both the distance travelled and time used are important factors of accessibility. The World Health Organization recommends the use of travel time instead of distance covered to asses geographical accessibility (WHO, 2001).This is in addition to the cost of travel to the point of service provision (MOH, 2009).

Geographical access is an important aspect of accessing healthcare in low and medium income countries. It has been established that there is an inverse relationship between distance or travel time to health facilities and use of health services. Good roads which are rare in poor areas of developing countries are required for people to go to the health facilities as well as distribution of essential medicines to health facilities and supervision of service provision (Oketch, 2016).

Lack of transport and communication services limits access to healthcare. This is even more serious in the remote areas where communication becomes cut off by adverse

weather conditions such as rainy weather which renders roads impassable. Developing countries are characterized by poor road network comprising of impassable roads serving the remote villages. Patients can barely find a means of transport to the health facilities when need arises. This has led to the use of crude means of transport such as donkeys cart including those for patient's referral (Beran, 2019)

Poor transport and communication network means that more resources in terms of time and money are spent on travel related expenditure which in turn act as obstacles to accessing essential medicines for the poor. However, the government can overcome this challenge by seeking to improve access to health services by building more clinics and hospitals in the rural setting.

According to a study done in Rwanda by the ministry of health a population should have access to healthcare services within an hour of walking (Ulises, 2012). A study done by the ministry of health in Kenya concluded that use of 0.41 days wages for travel to access healthcare was found to be high posing a question of how geographically accessible is healthcare services and in this regard medicines for non-communicable diseases (MOH, 2009).

## **2.7 Gap in existing literature**

The promulgation of the 2010 constitution of Kenya prescribed the devolution of governance of healthcare system in Kenya. In the new devolved system each county budgets for and purchases essential medicines for their health facilities from suppliers of their choice (Kirwa, 2017).

Several studies have been carried out both in Kenya and other countries such as Uganda and South Africa on the accessibility of essential medicines under devolved systems. The observation being that devolution has increased the decision space for the management of essential medicines and medical supplies and its expected that better supply system should be observed (Tsofa, 2017).

None of these studies has however focused on accessibility of essential medicines for non-communicable diseases in Trans Nzoia County where the prevalence of non-communicable diseases is on the rise at 30% according to Trans Nzoia County integrated plan 2018

In a study done by Mecca in 2016 on availability of essential medicines, it was recommended for a study to be done on availability of essential medicines in a devolved health system.

## **2.8 Theoretical frame work**

The theory of decision space by Bossert 1998 shall be applied. Decision space is a terminology used to describe the authority, responsibility and the range of choice granted to a decentralized unit of a government by the central government to decide on a number of functions as well as resources. It represents the extent of decentralization to an organization. It is presumed that the more the decision space, the more efficient, innovative and responsive the management would become to local conditions or problems. This would hence be expected to improve the quality of service delivered (Kirwa, 2017). By looking at the WHO-MSH 2000, Frost and Reich 2010 and the WHO

2004 equitable access to essential medicines framework, three domains that are considered as determinants to access to essential medicines are identified: availability, affordability and adoption (WHO 2004; Maryam 2013). Availability represents all procurement delivery functions. Adoption represents demand and uptake as well as physical and social factors affecting such uptake. Affordability integrates the cost of acquisition by health facilities and the cost at which essential medicines are offered to patients. These three domains are affected by the decision space and interact in multiple dynamic ways (Figure 2.1) and not simple linear patterns. With devolution of health services, all financial resources for health are disbursed to county governments and the authority to allocate and spend resources in various vote heads is exercised by county governments. This therefore means that county governments exercise authority in prequalification and listing of suppliers, as well as actual procurement of goods and services from listed suppliers through this decision space. This decision space integrates in this study since it has a net effect of determining when and where goods and services are available and at what prices.

Different institutions assume different roles at different levels. These roles are dependent on the degree of decentralization and authority distribution. The decision space has been applied to case studies of other decentralized health systems in developing countries such as Uganda, Zambia and Philippines (Bossert, 2002).

The theoretical framework, Figure 2.1 is a perceived link between dependent and independent variables, seeking to show the relationship between availability, affordability

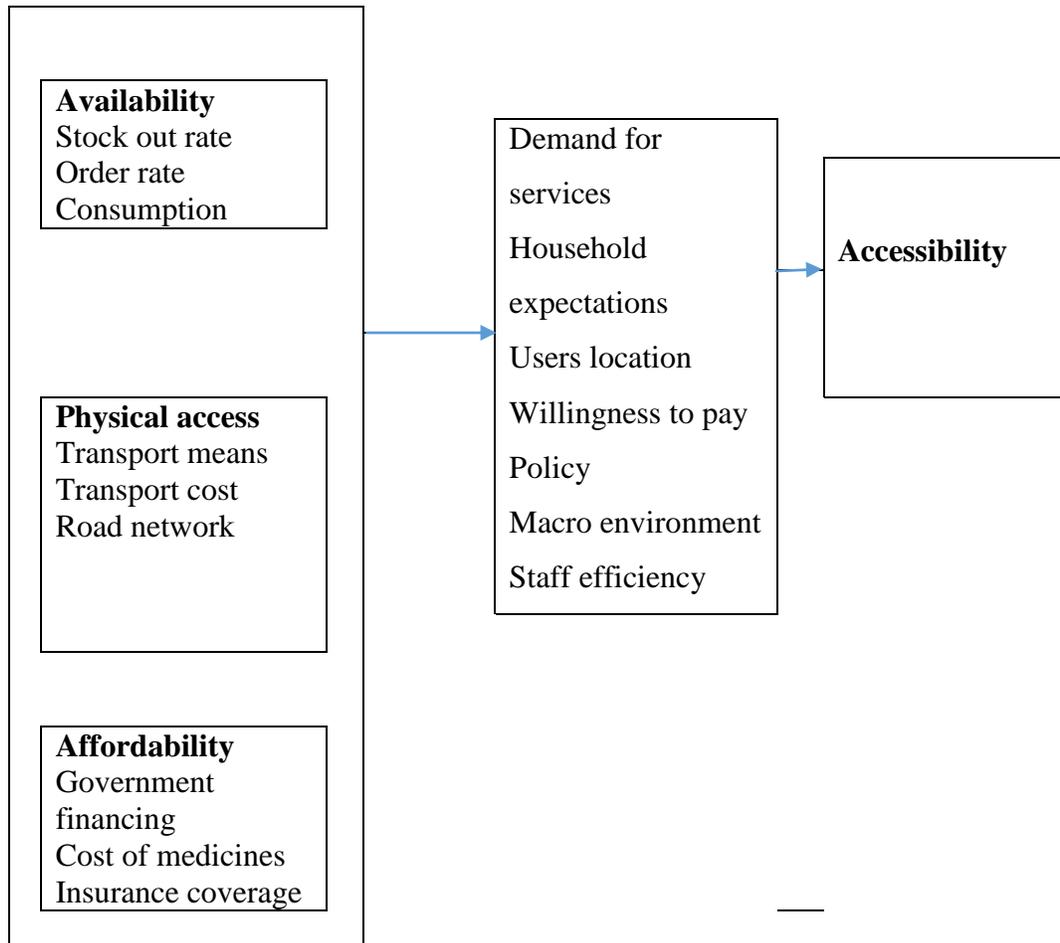
and physical accessibility and their direct influence to accessibility of the essential medicines for non-communicable diseases.

## Conceptual framework

**Independent variable**

**Intervening Variable**

**Dependent  
Variable**



**Figure 2.1: The relationship between independent and dependent variables.**

## **CHAPTER THREE**

### **MATERIALS AND METHODS**

#### **3.1 Introduction**

This chapter provides a detailed description of how the required data was obtained, processed, analyzed and interpreted in order to fulfill the research objectives. The methodology elements considered here includes; research design, study area, target population, sample selection, sample size, research instruments, the validity and reliability of the instruments, data collection procedures, data analysis techniques and lastly ethical considerations and operationalization of the variables.

#### **3.2 Study design**

Research design constitutes the blue print for the collection, measurement and analysis of data to achieve the stated objectives. This study adopted a descriptive cross-sectional design, employing quantitative and qualitative techniques for data collection. This design allows data collection at a point in time. It also describes the characteristics of the sample being studied and can generalize the findings from the sample to a larger population.

In this design data was collected at a point in time, as and at when the researcher visited the health facility to get real time information.

#### **3.3 Study Site**

The study was conducted in Trans Nzoia County located in the former Rift Valley Province. It borders Uganda to the north west, West Pokot to the north, Uasin Ngishu to

the south, Elgeyo Marakwet to the east and Bungoma to the west. Its area is 2,479km\*2. Its population according to the 2009 census was 818,757 with male being 407,170(50%) and female being 411,587(50%).The age distribution of the bulk of the population at 50.2% was between the age 15-64 years (Kenya National Bureau of Statistics 2015).

Agriculture is the main economic activity in Trans Nzoia County. Main crops produced include maize, beans, finger millet, sweet potatoes, bananas, irish potatoes and assorted vegetables (Trans Nzoia County Strategic Plan, 2018).

The mean life expectancy at birth is 55 years with 54 years for males and 56 years for females. This is slightly higher than the national average that is 52 years. The annual death rate is estimated to be 9 people in every 1000 people. Amongst the key sectoral strategies to improve health indicators are improvement of medicines procurement and stock management (Trans Nzoia County Integrated Plan 2018)

The study was conducted in five hospitals within Trans Nzoia County. These hospitals included one level IV hospital from each of the five sub counties.These were Kitale County Referral Hospital, Endebes Sub County Hospital, Kapsara Sub County Hospital, Saboti Sub County Hospital and Kwanza Sub County Hospital. The criteria used for selection was dependent on government classification of hospitals and the caliber of essential medicines that each hospital was required to stock. These were the only hospitals at that level (level IV) in Trans Nzoia County. Another significant characteristic of these county and sub county level hospitals was the availability of past records due to existence of a very effective record keeping system both in manual and electronic forms. In addition, these hospitals had special medical outpatient clinic days manned with

specialist personnel and equipped with advanced laboratory techniques for testing and monitoring various NCDs.

### **3.4. Study period**

The study was conducted over a period of three months.

### **3.5 Study population**

Out-patients with any or all of the four major non communicable diseases that is cancer, diabetes, cardiovascular disease and chronic obstructive pulmonary disease attending outpatient clinics in any of the 5 sub county hospitals within the five sub counties of Trans Nzoia county. According to the Trans Nzoia County strategic plan of 2018 this population is estimated to be 245,627.

#### **3.5.1 Inclusion criteria**

Participants suffering from non-communicable diseases that had attended the medical outpatient clinic and who were above 18 years of age and were willing and able to give informed consent were included in the study. The key informants were members of staff who had served for more than two years in facilities categorized as level IV tier and above and were willing to provide informed consent. This is because they were aware of the procedures and processes in those hospital including the flow of essential medicines and medical supplies.

### **3.5.2 Exclusion criteria**

Participants suffering from non-communicable diseases but not attended to as outpatients were not included in the study. In addition to Patients below 18 years of age, individuals not willing or unable to give informed consent, Key informants with less than two years of experience as well as facilities below level IV tier were also excluded from the study.

### **3.6 Sampling procedure**

Cluster sampling design involved selection of clusters and eligible participants. In the first stage, five clusters were selected which were the level IV hospitals in each sub county. There was only one level IV hospital in each of these sub counties. A uniform sample size of 64 participants was derived from each cluster as shown in equation below. The subjects in each cluster were subjected to simple random sampling in the second stage. This was to ensure that a very representative sample was obtained even in terms of age and sex.

### **3.7 Sample size determination**

The sample size was calculated using the Cochran 1963 formula.

$$n = \frac{z^2 pq}{d^2}$$

Where:

n the desired sample size

z the standard normal deviate at the required confidence level.

p the prevalence of non-communicable diseases in Trans Nzoia County (30%)

q 1-p

d the level of statistical significance set (5%)

$$n = \frac{(1.96)^2(0.30)(0.70)}{(0.05)^2}$$
$$=322$$

Using the above formula, a sample size of 322 participants was arrived at and rounded off to 320 so as to get an absolute figure for each cluster. This was divided into five equal clusters each with 64 participants.

The key informants were purposively selected in each hospital until a saturation level was attained. They included: a hospital pharmacist, nursing officer in charge, procurement officer, medical superintendent as well as stores person.

Complete enumeration of the essential medicines for management of the non-communicable diseases in the Kenya essential medicine list of 2016 was done and a total of 62 essential medicines were obtained comprising of essential medicines for management of the four major non-communicable diseases. There was no creation of a representative sample.

### **3.8 Data collection instruments**

The tools and structure for data collection was a non-sequential process that comprised three steps of information gathering. These were structured questionnaires to patient participants which were researcher administered. The questionnaires sought to gather information on their demographics as well as information relevant to each of the specific objectives. Key informant interviews guides were also administered to the staff members

working in the hospitals. Check lists were also used to collect information from selected documents such as bin cards and price lists within the hospitals containing information on the specific objectives. The tools are found at the appendix 2,3 and 4.

### **3.9 Data collection procedure**

Participants were randomly selected from the patients who had attended the MOPC clinic. Each of the selected participant was taken to through the objectives of the study and thereafter asked if they would like to participate. Those who agreed were asked each of the questions in the questionnaire as the researcher filled in the details.

For the key informants they were issued with the key informant guide which they filled themselves.

Checklists were filled by the researcher after going through the bin cards, invoices and price lists in the hospital

### **3.10 Data analysis and presentation**

Data analysis was done by first entering quantitative data into Microsoft excel for cleaning. Double entry was done, that is two sets of data were entered in excel, to minimize errors. It was then checked for accuracy and completeness. Descriptive methods of data analysis were used where the mean, median and frequencies of the data were calculated. Inferential methods of analysis included Chi square and odds ratio. Qualitative data was first transcribed. The transcribed data was then analyzed by coding and creation of themes and categories while some of the reports from the key informant was reported as said by them.

Chi square and regression analysis was used to test association.

The data was then presented in form of simple tables, bar graphs and pie charts for ease of interpretation.

**Table 3.1: Summary of data analysis and presentation**

Objective	Independent variable	Dependent variable	Data analysis	Data presentation
To determine the availability of essential medicines for NCD	Order rate Stock out Consumption	Prescription fill rate	Descriptive statistics; means, percentages	Pie Charts and Bar graphs
To determine the affordability of essential medicines for NCD	Government financing Price of medicines	Prescription fill rate	Descriptive statistics; percentages  Means  Frequencies	Tables  Graphs
To determine physical accessibility of essential medicines for NCDs	Transport means Transport cost Road network	Prescription fill rate	Descriptive statistics; frequency distribution	Bar graphs  Tables  Pie charts

### **3.11 Validity**

Validity is the ability of an instrument to measure what it is supposed to measure. It considers whether data obtained in the study represents the variables of the study. This is important as conclusions drawn from such data are more accurate, relevant and meaningful (Kothari, 2008). The researcher used content validity to measure the degree to which data collected using a particular instrument represents. A pilot study was done to ensure the validity of the study instruments. A pilot study is important in testing the validity of instruments and clarity of language (Mugenda and Mugenda, 2003). The piloting was done in Mt.Elgon County hospital and it was not included in the main study. However the data was used to test the data collection instruments. In order to test the tools, a test sample of 10% of the study sample size was used. This is approximately 32 participants. The aim of the pilot study was to assess the clarity of the questions in the questionnaire observation checklist and key informant guide.

### **3.12 Reliability**

Reliability refers to the consistency that an instrument demonstrates when applied under similar situations (Mugenda and Mugenda, 2003). To test the reliability of the instrument, test-retest method was used. The instruments were pre tested during the pilot study too. Consistency of the data instrument was tested by administering the instrument twice to the respondents to check on the uniformity of their responses. The responses were analyzed where reliability coefficient was determined as 0.78 and this was considered high enough for reliability of the instrument (Gliem, 2003).

### **3.13 Logistical and Ethical Consideration**

Ethical consideration and approval was sought from the institutional research and ethics committee (IREC) of Masinde Muliro University of Science and Technology and ethics and training committee of the department of health of the county government of Trans Nzoia. Permit for conducting the research was sought from National Commission for Science, Technology and Innovation (NACOSTI).

#### **3.13.1 Informed consent**

Before any participant was recruited, information pertaining the research was explained in detail. Thereafter, participants were provided with a consent form and required to sign as proof of acceptance to participate in the research. They were informed that they could quit the research at any point without reprimand.

#### **3.13.2 Confidentiality**

The principle of confidentiality was applied in that information disclosed by participants was treated with privacy in a relationship of trust. The information was not divulged to others. Only the relevant people such as data analysts had access to this information. Identity of participants was not disclosed and instead, codes were used.

#### **3.13.3 Beneficence**

During data collection, as the researcher gathered information from participants, they were also given health education to fully understand their condition and best care.

Participants were educated on risk factors, negative prognosis, proper diet and the need for physical exercise.

#### **3.13.4 Non maleficence**

Participants were not exposed to any known physical, emotional and financial harm. There were no invasive procedures involved. None of the participants reported any unusual level of temporary or permanent discomfort during the research period.

## **CHAPTER FOUR**

### **FINDINGS**

#### **4.1 Introduction**

This chapter presents results, presentation, and interpretation of the data on the study. The study was designed to investigate accessibility of essential medicines for the non-communicable diseases in the devolved system of government in Trans Nzoia County.. Results are described as frequencies simple percentages, means, and standard deviations as appropriate depending on the nature of the variable.

#### **4.2 Questionnaire Response Rate**

The study involved 320 respondents residing in Trans Nzoia County. A total of 305 questionnaires were clean and completed for data analysis. This represents 95% of the sample size. A response rate of 50 % is adequate, a response rate of 60 % is good, and a response rate of 70 % is very good. Therefore, the 95% response rate reported for this study formed an acceptable basis for analysis and reporting. While we should not expect a 100% response in voluntary studies, researchers utilizing questionnaires should aim for a high response rate in order to have a meaningful generalization (Baruch & Holtom, 2008; Mugenda and Mugenda 2003).

### **4.3 Demographic Characteristics of the respondents**

This information aimed at getting the demographics of the respondents to assist the researcher get information that may be necessary for doing inferential statistics and also explain the emerging patterns.

The socio-demographic variables of the respondents showed that 61% (n=185) were between 35-64 years of age and 39% (n=119) were over 64 years. The results showed that a great proportion of the respondents were female 65% (n=198) and male at 35% (n=107). Proportionately, many respondents had primary level as the highest level of formal education 44% (n=134) with 26% (n=80) having secondary level, 14% (n=43) tertiary level and 16% (n=48) had no form of education. The self-report results showed that the economic activity of many of the respondents was farming 53% (n=160). A great proportion of the respondents reported to have cardiovascular diseases 59% (n=179) and many of the respondents reported to have suffered for more than 7 years 51% (n=155,) as shown in table 4.1.

**Table 4.1: Socio-demographic characteristics of Study Participants**

Demographic characteristics		N(number of respondent)	%(percentage of respondents)
Age	18-34 Years	1	0.3
	35-64 Years	185	<b>60.7</b>
	>64 Years	119	39.0
Gender	Male	107	35.1
	Female	198	<b>64.9</b>
Level of education	Primary	134	<b>43.9</b>
	Secondary	80	26.2
	Tertiary	43	14.1
	None	48	15.7
Economic activity	Formal Employment	37	12.1
	Self-Employment	90	29.5
	Farmer	160	<b>52.5</b>
	Retired	11	3.6
	Other(housewife)	7	2.3

#### **4.4 Bi-variate analysis of socio-demographic characteristics associated with Health status**

Bivariate analysis on socio-demographic factors that are associated with health status showed that there was a borderline significant relationship between age and health status in the study area (OR: 0.7; 95% CI: 0.7 – 1.5; p=0.06). The respondents aged 64 years and below were 80% less likely to have poor health status compared to respondents aged 64 years and above. Males were 1.3 times more likely to have poor health status

compared to women (OR: 1.3; 95% CI: 0.7 – 2.3; p=0.97). The level of education was not statistically significant with health status with the results showing that respondents who had an education of secondary or below being 1.7 times more likely to have known poor health status compared with their counterparts with tertiary level of education (OR: 1.7; 95% CI: 1.5 – 3.0; p=0.14). Similarly, respondents who suffered from diabetes and cancer were 80% more likely to have poor health in contrast to those suffering from cardio-vascular diseases and chronic obstructive pulmonary diseases (OR: 1.8; 95%CI: 0.6 – 2.2; p=0.008) as shown in table 4.2.

**Table 4.2: Socio demographic characteristics associated with health status**

	N	Health status		Over all OR	95% CI	p value
		Poor	Good			
<b>Age</b>						
≤64 Years	186	85.3(157)	14.7(29)	1.1	0.7 – 1.5	<b>0.06</b>
>64 years	119	93.2(111)	6.8(8)			
<b>Gender</b>						
Male	107	61.7(66)	38.2(41)	1.3	0.7 – 2.3	0.97
Female	198	61.2(121)	38.8(77)			
<b>Highest level of education</b>						
Secondary and below	262	73.5(193)	26.5 (69)	1.7	1.5 – 3.0	0.14
Tertiary	43	54.4 (23)	45.6(20)			
<b>NCD suffered</b>						
Cancer/Diabetes	106	58.8(62)	41.2(44)	1.8	0.6 – 2.2	<b>0.008</b>
cardio-vascular disease/COPD	199	33(66)	67(43)			
<b>Time suffered disease</b>						
≤7 years	150	50(75)	50(75)	0.6	0.1 – 2.6	0.96
>7 years	155	49.5(77)	50.5(78)			

#### **4.5. Objective 1: To determine availability of essential medicines for non-communicable diseases in Trans Nzoia County**

##### **4.5.1 Availability of essential medicines for non-communicable diseases participants self-report**

The study found that only 27% (n=83) obtained all the medicines prescribed. Most of the respondents received half of all the prescribed medicines for non-communicable diseases on that day 31% (n=93) while 14% (n=14) did not receive any of the medicines prescribed. The study found that most 73% (n=222) of the respondents received at least half of all the prescribed medicines for non-communicable diseases while 27% (n=83) received less than half of the prescribed medicines.

When asked if there were instances when the non-communicable diseases essential medicines were more available, majority agreed 93% (n=283) while 7 % (n=220) said that there were no periods when the medicines were more available. In addition, 59% (n=178) reported that there were no periods where they could not get non-communicable diseases essential medicines at all as shown in table 4.3.

**Table 4. 3: Availability of essential medicines for NCDs- participant’s self-report**

Responses to key questions		N(number of respondent)	(percentage of respondents)%
Amount of NCD drugs obtained	Less than half	69	22.6
	Half	93	30.5
	More than half	46	15.1
	All	83	<b>27.2</b>
	None	14	4.6
Periods NCDs medicines more available	Yes	283	<b>92.8</b>
	No	22	7.2
Periods when NCD medicines not available at all	Yes	127	41.6
	No	178	<b>58.4</b>

#### **4.5.2 Availability of essential medicines for non-communicable diseases on day of visit**

Observation checklist results showed that of the five facilities observed all of them had metformin on the day of visit, none had gilbenclamide on day of visit, only one had insulin 70/30 on day of visit and three hospitals had hydrochlorothiazide on day of visit.

Table 4.4 gives a summary of the observations.

**Table 4. 4: Availability of essential medicines on day of visit**

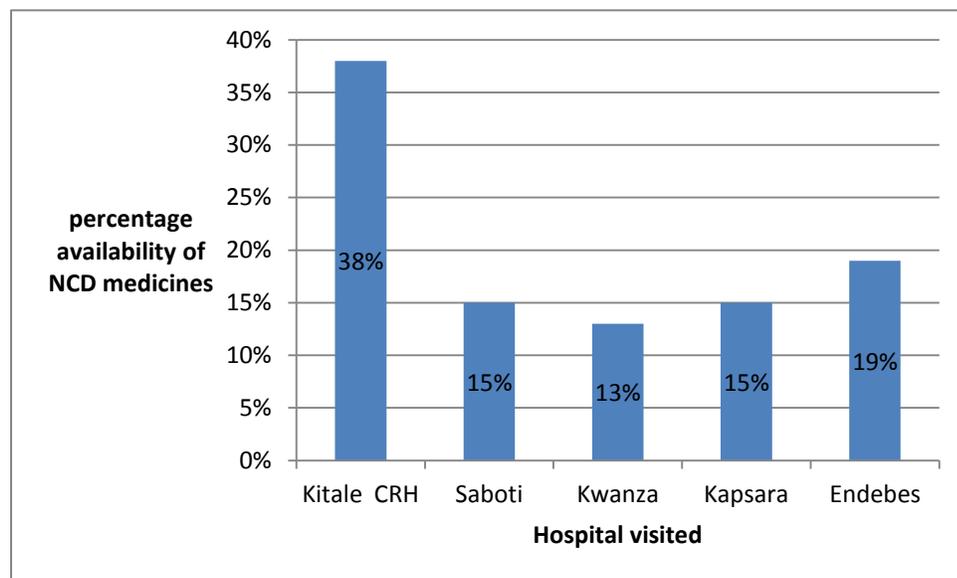
Medicine type Responses		N(number of hospitals)	(percentage of hospitals with medicine)%
Metformin tablets	Not available(NA)	0	0.0
	Available(A)	5	<b>100.0</b>
Glibenclamide tablets	NA	5	<b>100.0</b>
	A	0	0.0
Insulin 70/30	NA	4	80.0
	A	1	<b>20.0</b>
Soluble Insulin	NA	0	0.0
	A	5	100.0
Amiloride tablets	NA	4	80.0
	A	1	20.0
Furosemide tablets	NA	0	0.0
	A	5	100.0
Hydrochlorothiazide tablets	NA	2	40.0
	A	3	<b>60.0</b>
Spironolactone tablets	NA	3	60.0
	A	2	40.0
Digoxin tablets	NA	3	60.0
	A	2	40.0
Carvedilol tablets	NA	2	40.0
	A	3	60.0
Amlodipine tablets	NA	0	0.0
	A	5	100.0

#### **4.5.3 Availability of essential medicines for non-communicable diseases per hospital visited**

The study results found that the availability of these essential medicines varied from one hospital to another. Kitale County Referral Hospital was found to have the highest

availability of these medicines at 38%, Kwanza at 13%, Saboti at 15%, Endebes at 19% and Kapsara at 15%.

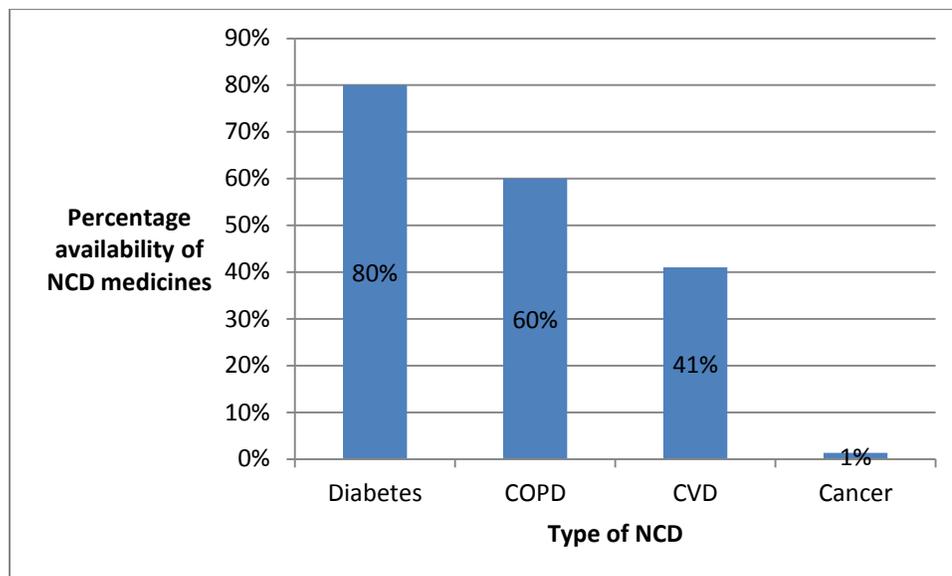
It was found that the availability of these medicines also differed in each hospital Kitale County Referral Hospital was found to have medicines for chronic obstructive pulmonary diseases as the most stocked at 100% (n=3), same with Kwanza Sub County Hospital at 67% (n=2). Endebes and Kapsara Sub County Hospitals were found to have the diabetes medicines as most stocked at 50% (n=2) and 75% (n=3) respectively. Saboti Sub County Hospital was found to have stocked cardio vascular diseases medicines most at 35% (n=6) as shown on figure 4.1.



**Figure 4.1: Availability of essential medicine per hospital visited**

#### 4.5.4 Availability according to the type of non-communicable disease treated.

The study further sought the distribution of the various medicines based on the type of the four non communicable diseases that they treated. The results showed that the medicines for management of diabetes were most available at 80% followed by those for chronic obstructive diseases at 60% and those of cardiovascular diseases at 41%. Medicines for management of cancer were the least available 1.3 % as shown in figure 4.2.



**Figure 4. 2: Availability according to the type of essential medicine.**

#### 4.6 Stock out of essential medicines for non-communicable diseases

Results from observation checklists showed that from all facilities visited, the mean number of equivalent days Insulin 70/30 was out of stock per year was 61 days ( $\pm 61$ ) with the highest number of equivalent days out of stock per years being 122 and the minimum being 0 days, The mean number of equivalent days hydrochlorothiazide tablets

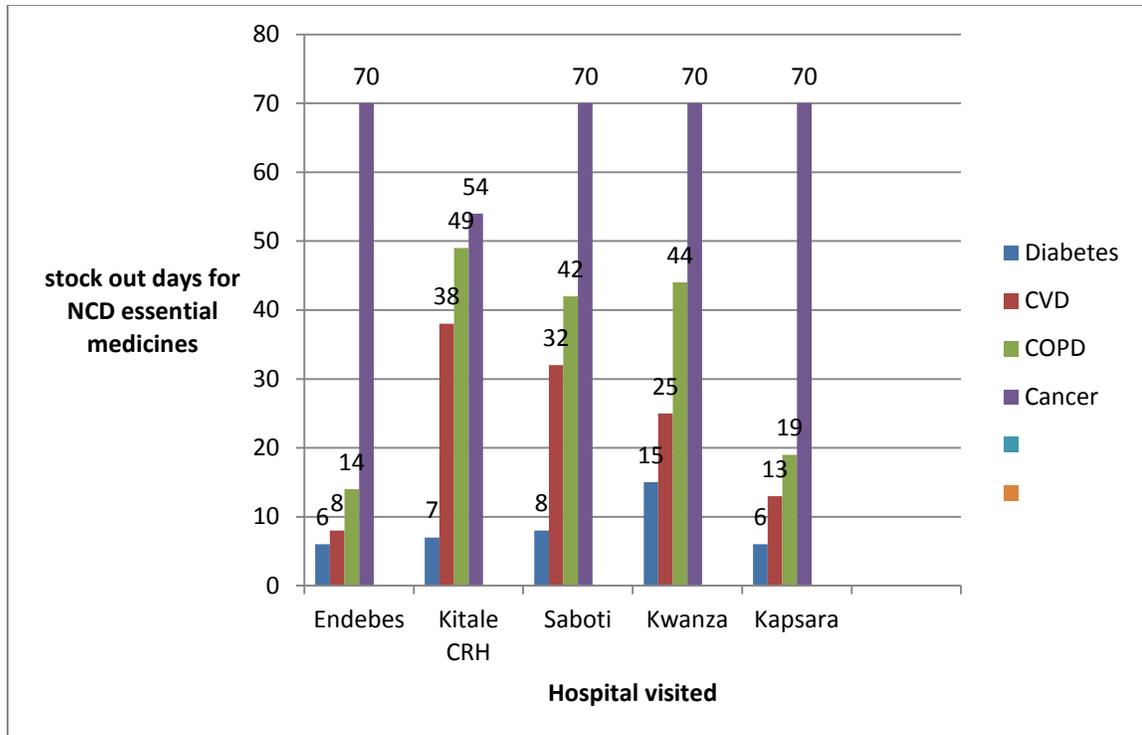
were out of stock per year was 110 days ( $\pm 163$ ) with the highest number of equivalent days out of stock per years being 365 days and the minimum being 0 days. The mean number of equivalent days Beclomethasone inhaler was out of stock per year was 219 days ( $\pm 199$ ) with the highest number of equivalent days out of stock per years being 365 days and the minimum being 0 days. The table 4.5 gives a summary of the responses.

**Plate 4.1: Observation schedule of equivalent days out of stock of selected NCD medicines**

<b>Medicine</b>	<b>Mean</b>	<b>Maximum</b>	<b>Minimum</b>	<b>Standard Deviation</b>
Metformin tablets	.00	.00	.00	.00
Glibenclamide tablets	.00	.00	.00	.00
Insuline 70/30	<b>61.00</b>	122.00	.00	61.00
Solube insulin	36.60	183.00	.00	81.84
Amiloride tablets	292.00	365.00	.00	163.23
Furosemide tablets	109.60	365.00	.00	151.47
Hydrochlorothiazide 40mg tablets	<b>109.60</b>	365.00	.00	163.29
Spironolactone tablets	255.60	365.00	.00	163.18
Diagoxin tablets	219.00	365.00	.00	199.92
Carvedilol tablets	170.40	365.00	.00	184.49
Amlodipinne tablets	24.20	121.00	.00	54.11
Enalapril tablets	.00	.00	.00	.00
Hydralazine tablets	243.40	365.00	.00	172.00
Losartan tablets	219.00	365.00	.00	199.92
Methyldopa tablets	73.00	365.00	.00	163.23
Glyceryl trinitrate	292	365	0	163
Isosorbide dinitrate	292.00	365.00	.00	163.23
Lidocaine injection	6.00	30.00	.00	13.42
Verapamil tablets	292.00	365.00	.00	163.23
Beclomethasone inhaler	<b>219.00</b>	365.00	.00	199.92

#### **4.6.1. Stock out days for different class of essential medicines and hospitals**

An analysis of the stock out situation for medicines of the individual non communicable disease found that medicines used for management of cancer had the highest stock out at 334 days per year followed by those for management of chronic obstructive pulmonary disease at 168 days. Essential medicines for management of cardiovascular diseases had a stock out of 124 days per year and those for management of diabetes at 42 days per year. The results further found that the out of stock situation was different for different essential medicines in different hospitals with the out of stock situation for diabetes medicines being highest in Kwanza hospital and those for cardio vascular diseases highest at Kitale County Referral Hospital. Essential medicines for chronic obstructive pulmonary diseases had highest out of stock at Kitale County Referral Hospital while those for cancers were completely out of stock except for the Kitale County Referral Hospital as shown in figure 4.3.



**Figure 4.3: Stock out days for different class of medicines and hospitals.**

Results of Key informant interviews showed that many respondents disagreed 71% (n=15) with the fact that the county was doing enough to ensure a steady supply of the essential medicines for NCDs. All the respondents 100% (n=21) agreed that they always run out of stock of these essential medicines. Reasons for running out of stock included inadequate funding (strongly agreed=60%), procurement bureaucracies (strongly agreed=50%) and poor inventory (strongly agreed=32%). Many 38% (n=8) respondents reported healthcare financing as the main factor influencing the availability of essential medicines for non-communicable diseases.

The study further sought to establish other factors influencing availability of non-communicable diseases essential medicines. When asked about the availability of essential medicines for NCDs, one key informant had this to say;

KII 1

*“procurement procedures are made complicated by county officers. Orders for procurement of drugs simply take a long time to move from one stage to another leading to unnecessarily long lead times. In the end we just have to deal with stock outs.”*

#### **4.7 Bivariate association between availability of essential medicine for non-communicable diseases and health status**

There was a significant association between the proportion of the prescribed drugs they had received and their health status  $\chi^2$  (df=12) =22.7, p=0.03. However, there was no significant association between the periods when they did not get the NCDs essential medicines at all and their perceived health status  $\chi^2$  (df=3) =1.711, p=0.842.

Table 4.6 shows a summary of the findings.

**Table 4. 5: Association between availability of essential medicine and health status**

Availability of EM		Health status				$X^2$	<i>p</i>
		Poor	Fair	Good	Excellent		
NCD medicines obtained	Less than half	9(13.0%)	46(66.7%)	14(20.3%)	0(0.0%)	22.7	0.030
	Half	6(6.5%)	60(64.5%)	27(29.0%)	0(0.0%)		
	More than half	1(2.2%)	27(58.7%)	18(39.1%)	0(0.0%)		
	All	3(3.6%)	39(47.0%)	40(48.2%)	1(1.2%)		
	None	1(7.1%)	9(64.3%)	4(28.6%)	0(0.0%)		
Periods when NCD medicines were more available	Yes	19(6.7%)	166(58.7%)	97(34.3%)	1(0.4%)	.833	.842
	No	1(4.5%)	15(68.2%)	6(27.3%)	0(0.0%)		
Periods when there were no NCD medicines at all	Yes	9(7.1%)	79(62.2%)	39(30.7%)	0(0.0%)	1.711	.635
	No	11(6.2%)	102(57.3%)	64(36.0%)	1(0.6%)		
What the county government could do to improve the availability of EM for NCDs?	Accelerate steps in procurement	3(6.1%)	21(42.9%)	25(51.0%)	0(0.0%)	13.42	.144
	Select well stocked suppliers	1(9.1%)	4(36.4%)	6(54.5%)	0(0.0%)		
	Institute administrative restrictions such as drug rationing	7(8.3%)	50(59.5%)	27(32.1%)	0(0.0%)		
	Increase funding for essential medicines	9(5.6%)	106(65.8%)	45(28.0%)	1(0.6%)		

## **4.8 Objective 2: To determine affordability of essential medicines for non-communicable diseases in Trans Nzoia County**

### **4.8.1 Affordability of essential medicines for non-communicable diseases**

From the self-report the study showed that majority of respondents 79% (n=241) perceived the cost of their routine non communicable disease essential medicines to be unaffordable.

### **4.8.2 Cost of one dose of essential medicine**

Results from observation checklists also showed that from all facilities visited, the mean cost of one dose of metformin tablets was 138Ksh ( $\pm 16$ ) with the highest cost being 150 and the lowest cost being 120 Kshs, the mean cost of one dose of Glibeclamide tablets was 78 Ksh ( $\pm 57$ ) with the highest cost being 180 and the lowest cost being 50 Kshs ,the mean cost of one dose of insulin 70/30 was 210 Ksh ( $\pm 57$ ) with the highest cost being 250 and the lowest cost being 200 Kshs and the mean cost of one dose of hydrochlorothiazide tablets was 46 Ksh ( $\pm 9$ ) with the highest cost being 50 and the lowest cost being 30 Kshs. The mean cost of beclomethasone inhaler was ksh 170 (#67) with the highest cost being ksh 200 and the lowest ksh 50 .Table 4.7 gives a summary of the responses

**Table 4. 6: Cost of one dose of selected non-communicable disease essential medicine**

	Mean	Maximum	Minimum	Standard Deviation
Cost of one dose metforming tablets	<b>138</b>	<b>150</b>	<b>120</b>	16
Cost of one dose Glibeclamide tablets	<b>78</b>	<b>180</b>	<b>50</b>	57
Cost of one dose insulin 70/30	<b>210</b>	<b>250</b>	<b>200</b>	22
Cost of one dose soluble Insulin	20	100	0	45
Cost of one dose Amiloride tablets	0	0	0	.
Cost of one dose Furosemide tablets	40	50	20	14
Cost of one dose hydrochlorothiazide 40mg tablets	<b>46</b>	<b>50</b>	<b>30</b>	9
Cost of one dose Spironolactone tablets	122	150	60	41
Cost of one dose Digoxin tablets	46	50	30	9
Cost of one dose carvedilol tablets	222	300	90	107
Cost of one dose Amlodipinne tablets	134	160	60	42
Cost of one dose Enalapril tablets	110	150	0	65
Cost of one dose Hydralazine tablets	98	240	50	95
Cost of one dose Losartan tablets	140	150	100	22
Cost of one dose Methyldopa tablets	88	100	50	25
Cost of one dose isosorbide dinitrate	60	60	60	.
Cost of one dose Lidocaine injection	5	20	0	10
Cost of one dose Verapamil tablets	30	60	0	42
Cost of one dose Aspirin 75mg tablets	140	300	100	89
Cost of one dose Artovastatin 20mg tablets	200	300	100	71
Cost of one dose Beclomethasone inhaler	<b>170</b>	<b>200</b>	<b>50</b>	67
Cost of one dose Epinephrine injection	72	200	10	74
Cost of one dose salbutamol inhaler	200	200	200	0

### **4.8.3 Mean affordability of the essential medicine for non-communicable diseases**

Results from observation checklists also showed that from all facilities visited, the mean affordability of metformin tablets was 0.464 ( $\pm$ .059) days wages with the highest cost being 0.510 and the lowest cost being 0.400, the mean affordability of insulin 70/30 was 0.604 ( $\pm$ .254) days wages with the highest cost being 0.840 and the lowest cost being 0.170 and the mean affordability of hydrochlorothiazide tablets was 0.156 ( $\pm$ .031) with the highest cost being 0.170 and the lowest cost being 0.100. The mean affordability of beclomethasone inhaler was 0.57 (#.224) with the highest being 0.67 and lowest 0.17. Table 4.8 gives a summary of the responses.

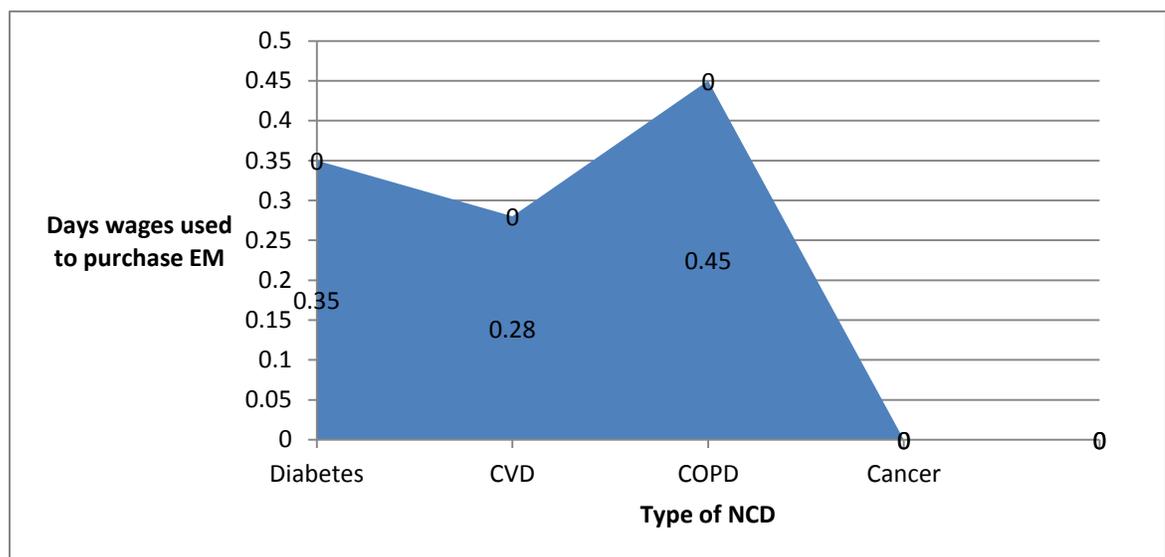
**Table 4.7: Mean affordability of selected non-communicable diseases essential medicines in days' wages.**

<b>Medicine</b>	<b>Mean</b>	<b>Maximum</b>	<b>Minimum</b>	<b>Standard Deviation</b>
Metforming tablets	<b>.464</b>	<b>.510</b>	<b>.400</b>	.059
Glibeclamide tablets	.256	.610	.130	.199
Insulin 70/30	<b>.604</b>	<b>.840</b>	<b>.170</b>	.254
Soluble Insulin	.068	.340	.000	.152
Amiloride tablets	.000	.000	.000	.000
Furosemide tablets	.136	.170	.070	.048
Hydrochlorothiazide 40mg Tablets	<b>.156</b>	<b>.170</b>	<b>.100</b>	.031
Spironolactone tablets	.410	.510	.200	.137
Digoxin tablets	.156	.170	.100	.031
Carvedilol tablets	.748	1.020	.300	.365
Amlodipinne tablets	.452	.540	.200	.142
Enalapril tablets	.372	.510	.000	.220
Hydralazine tablets	.330	.810	.170	.320
Losartan tablets	.384	.510	.050	.201
Methyldopa tablets	.238	.340	.000	.152
Glyceryl trinitrate	.000	.000	.000	.000
Isosorbide dinitrate	.067	.200	.000	.115
Lidocaine injection	.014	.070	.000	.031
Verapamil tablets	.067	.200	.000	.115
Aspirin 75mg tablets	.474	1.010	.340	.300
Artovastatin 20mg tablets	.672	1.010	.340	.237
Beclomethasone inhaler	<b>.570</b>	<b>.670</b>	<b>.170</b>	.224
Epinephrine injection	.242	.670	.030	.247
Salbutamol inhaler	.536	.670	.000	.300

#### 4.8.4 Affordability of essential medicine for non-communicable disease as per disease treated

The study also sought to establish whether there was a difference in the affordability of the medicines used to manage the different conditions. The results found that medicines for management of chronic obstructive pulmonary disease had the highest affordability ratio of 0.449 days' wages and those for diabetes at 0.348 days' wages, the least being those for

cardiovascular diseases.at 0.275 days' wages. The affordability of the essential medicines for cancer was not calculated as there were no records of any prices due to their unavailability in those facilities.



**Figure 4. 4: Affordability of essential medicine as per disease treated**

The study also showed that out the 305 participants only 33% (n=102) had a form of insurance.

On steps to be taken to improve affordability, 32 % the respondents said that there was need for the government to allocate more resources towards purchase of medicines.

Results from the key informant interviews showed that majority 81% (n=17) of the respondents agreed that medicine sold to patients are being subsidized by the county government. Majority 76% (n=16) agreed that the essential medicines for non-communicable diseases were affordable.

More information was sought about the affordability of these medicines and one key informant had this to say,

KII 2

*"It is not about the cost of medicines, many of these patients are very poor and cannot afford no matter how cheap we sell to them. The poverty level is high and sometimes as a staff you find yourself chipping in to assist the patient."* Another key informant had said, *"These drugs are funded in a cost sharing model, so in a way they are subsidized. In fact, these prices have remained the same since 2010."*

#### **4.9 Objective 3: To determine physical accessibility of essential medicines for non-communicable diseases in Trans Nzoia County**

##### **4.9.1 Physical accessibility of essential medicines for non-communicable diseases**

The respondents were asked to answer a few questions on physical accessibility of essential medicines for non-communicable diseases. When asked the amount of time they took to arrive to the health facility many respondents 65% (n=198) said they took at most

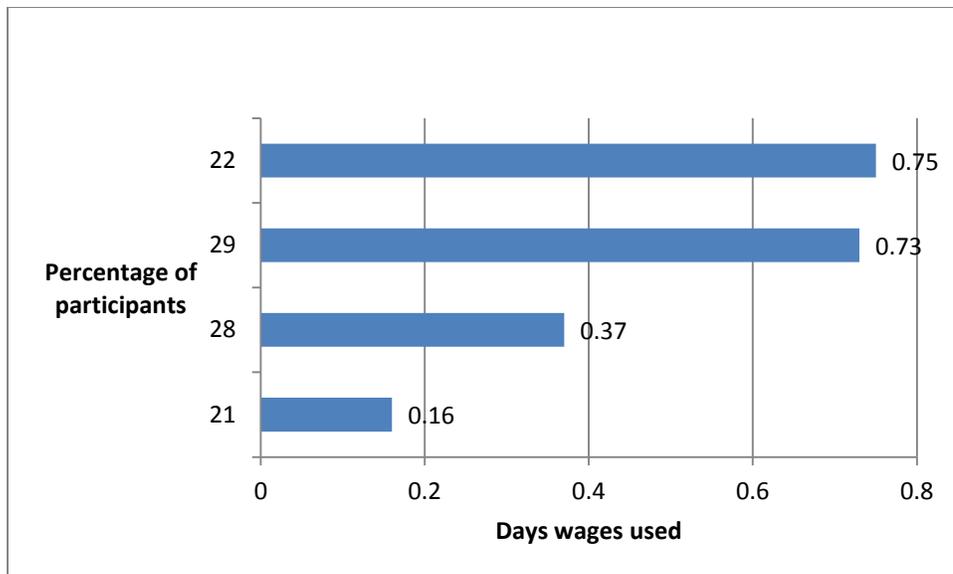
thirty minutes to arrive to the health facility. When asked how much it cost to arrive to the facility 29% (n=87) said they paid between one hundred and two hundred Kenya shillings as shown in table 4.9.

**Table 4. 8: Physical accessibility of essential medicines for non-communicable diseases**

Questions asked and responses		N(number of participants)	%(percentage of participants)
Amount of time used to travel to the health facility	< 30 Minutes	83	<b>27.2%</b>
	30 Minutes	115	<b>37.7%</b>
	1 Hour	82	<b>26.9%</b>
	>1 Hour	25	8.2%
Amount of money spent to go facility(Ksh)	≤50	64	21.1%
	51-100	85	28.0%
	101-200	87	<b>28.6%</b>
	> 200	68	<b>22.4%</b>

#### 4.9.2 Affordability of travel cost to the health facility

The affordability of the transport means was determined by using the daily wage of the lowest paid government worker which was 270 ksh (Kenya National Bureau of Statistics 2015) and the average affordability of the transport means was found to be 0.52 days' wages. Majority of the respondents 51% (n=155) had used 0.75 days' wages to travel to the health facility, 28% (n=85) had used 0.37 days' wages and 21% (n=64) had used 0.16 days' wages to arrive to the facility. Results obtained are as shown on the figure 4.5.

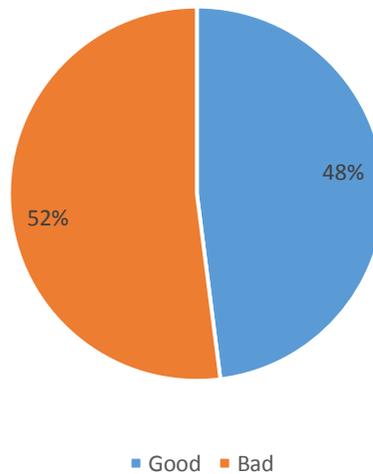


**Figure 4.5: Affordability of travel cost to the health facility**

### **4.9.3 Road network to health facilities**

Majority 52% (n=159) of the participants said that the road networks in their locality was very poor while 48 % felt that the road network was good as indicated in figure 4.6.

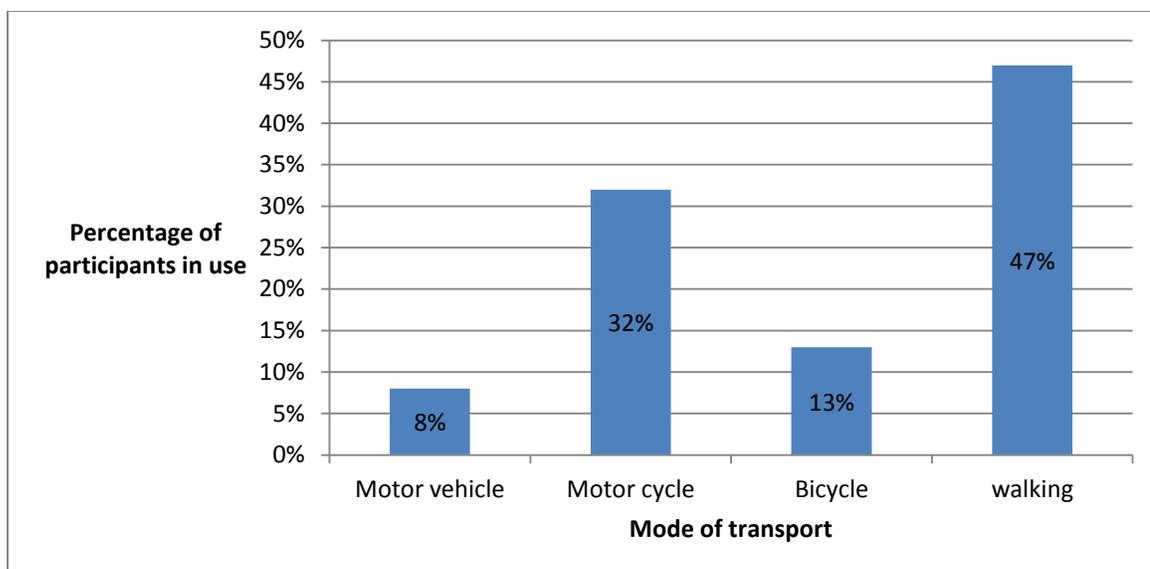
The road network were worse off during the rainy seasons and this area happens to be an area of log heavy rainfall seasons.



**Figure 4.6: Participants self -report on road network**

#### **4.9.4 Mode of transport to health facility**

When asked about the means of transport used majority 47% (n=143) said that they arrived at the facilities by walking with use of motor vehicle being the most unpopular means of transport at 8% (n=24). A good number 32% (n=98) used motorcycle while 13% (n=40) used the bicycle as shown in figure 4.7.



**Figure 4.7: Mode of transport to health facility**

Qualitative data from key informants showed that the health facilities were relatively within the participant’s reach. A key informant had this to say,

KII 3

*“most of these patients come from nearby villages. Most of them actually just walk to the health facility. Only the very old or sickly patients take up motorbikes or vehicles to this facility. I cannot really say that there is a problem in terms of distance. However, we hope that these services can be provided at the health centers like we do for other diseases”*

## **CHAPTER FIVE**

### **DISCUSSION**

#### **5.1 Introduction**

With the paradigm shift in the burden of disease in low and medium income countries from communicable to non-communicable diseases then the issue of accessibility to affordable essential medicines gets more importance in the management of the health systems. This is especially compounded by the fact that the treatment is often a lifelong and therefore no supplies or interrupted supply of these essential medicines for non-communicable diseases in the public health facilities and high cost in the private facilities will greatly affect the adherence to treatment. This will negatively affect the outcome of the disease (Robertson, 2015).

#### **5.2.1 Availability of essential medicines for non-communicable diseases**

This study found that the mean availability of essential medicines for non-communicable diseases was 23%. The mean availability for non-communicable disease essential medicines in Kenya according to the SARAM report of 2014 was estimated to be 25%. The report also estimated that of Trans Nzoia county to be 15% (MOH, 2014). The mean availability of 23% shows that there was a slight improvement in this parameter. With devolution of health era essential medicines are meant to be available to all in a functioning health system at the right dosage form, in good quality, in adequate amounts and affordable prices. Non availability of essential medicines lowers the credibility of a

public health system (Sangeeta, 2015) which in turn lowers its effectiveness and its adequate utilization (Sakthivel, 2005). This therefore pushes the patients away from the public health facilities to the private and faith based organizations where studies have shown to have better access to essential medicines in terms of availability

The results of the study found that Kitale County Referral Hospital had the highest availability level of 38%. This was attributed to the fact that there was partnership between the hospital and AMPATH (Academic Model Providing Access to Healthcare) which supports the hospital with some of these medicines. This reiterates the importance of partnership between the government and other agencies such as the non-governmental organizations in bringing healthcare closer to the people to achieve the universal health coverage. There was also a center for chronic disease management within the facility and therefore this called for better inventory management of these medicines at this hospital. The availability was however far much lower than the recommended 80% (WHO, 2014).

The study findings agreed with those of a meta-analysis of surveys carried out in low- and medium-income countries on essential medicines for NCDs which showed that the average availability was 36% (Cameron, 2011).

As part of the global response to the non-communicable diseases the World Health Organization recommends an 80% availability of the essential medicines and medical technologies for the management of the major non-communicable diseases at both the public and private sector (WHO, 2014). An example used to measure the availability of these essential medicines is hydrochlorothiazide, a first line medicine for management of hypertension and normally available in a wide range of cheap generics. It is also used as a

tracer medicine by both the ministry of health and the world health organization. The study found it to have an availability of 60%, lower than the recommended WHO 80%. It was expected that such a medicine would be available in all health facilities providing chronic disease management services due to its core role and its low prices. This implies that it would be difficult to have the other medicines meant for non-communicable diseases available if getting this cheap, readily available medicine was still suboptimal. The study findings concur with findings of WHO 2003 which reported low and medium income countries to have a mean availability of 50% (WHO, 2003).

Poor availability has also been documented in countries like India despite it being a giant generic medicines producer. It is also one of the countries with a devolved health system and with it being the pharmaceutical giant it was expected that there would be no occurrence of poor availability of these essential medicines in its health facilities.

A study done in Vietnam on accessibility of essential medicines for non-communicable diseases also found that there was poor availability of resources for management of NCDs including essential medicines at 50% point in time availability. It was lowest for cancer medicines which only had one medicine for palliative care (David, 2019). Therefore, this study affirms that indeed there is poor availability of essential medicines for non-communicable diseases in low and medium countries where Trans Nzoia County of Kenya belongs.

The low availability of medicines also resonates with findings of studies done in Uganda and South Africa. The studies found that the devolved units of government used most of the resources allocated to the health function in purchase of visible items such as

ambulances, refurbishing of hospitals and even in construction of new health facilities. They however paid very little attention in purchase of the very essential medicines which are used by consumers as a measure of performance of the effectiveness of the health system (Bossert, 2015) The same was experienced in Kilifi county according to a study by Tsofa *et al* 2017 where it found out that the county government concentrated on the larger visible projects that would gain them a political mileage at the expense of the very essential medicines and other commodities

Availability of essential medicines is critical to any health service delivery system in a community. Unavailability of these critical essential medicines in the public sector often forces the population to seek healthcare services from the private sector where they are more available but at the same time costlier, to some completely unaffordable. The global leadership priorities for WHO is increasing the access to affordable, effective, quality assured medical supplies (WHO, 2014).

The study found insulin 70/30, a very critical medicine in management of diabetes to have poor availability of 20% with only one facility having the essential medicine. Availability of common drugs for non-communicable diseases like insulin 70/30 is a well-recognized problem in the health system of most low and medium income countries. Most of the low and medium income countries tend to have sub optimal levels of this medicine which happen to be life saving for the diabetic patients (Beran, 2010). This scenario often leads to referral of the patients to health facilities that are further away from them or to private facilities raising the cost of the management of the disease to the patient. Another alternative is that patients forego their treatment which poses even a

larger threat in terms of progression of the disease to even more complications such as retinopathy and diabetic keto-acidosis which is life threatening and more expensive to manage. This poor availability also resonates to a study done in Bangladesh, Nepal and Malawi which showed poor availability at a point in time of the medicines for non-communicable diseases in the public sector at 36 % (Mendis, 2007).

The ever-increasing prevalence and burden of non-communicable diseases results in many patients being unable to receive the required prompt treatment and care. This in turn leads to quick progression of the disease leading to development of complications and co-morbidities which are in turn more expensive to treat and often leads to poor prognosis. (Gowshall, 2018). Universal access to healthcare is heavily dependent on availability of quality assured medicines and health products that are affordable to the end user (Robertson, 2015).

Even with the availability of low-cost generic essential medicines for non-communicable diseases, essential medicines are still unavailable and unaffordable in most low and medium income countries. This is in part attributed to the high levies and taxes that are sometimes imposed on medicines and the uncontrolled mark ups by distributors and retailers. This non-availability of essential medicines was cited as the most important barrier to quality healthcare services by consumers (MOH, 2009).

### **5.2.2 Stock out for essential medicines for non-communicable diseases**

The average stock out of the essential medicines for management of the four major non-communicable diseases was found to be 202 days per year. This is a very high stock out

rate compared to 46 days reported for the general essential medicines in 2014. Medicine stock out in health facilities is an indicator of the overall performance of the health delivery system. The ministry of health classifies 30 days of stock out as serious and beyond 90 days as critically jeopardizing health service delivery (MOH, 2009).

The study found that stock out of individual drug was highly varied with some as high as a hundred and others at zero percent. This implied that some essential medicines for non-communicable diseases were not available in the entire one-year study period implying that patient suffering from these diseases were forced to seek them elsewhere. Some medicines had a stock out rate of 0 % implying that there was a skewed prioritization in procurement of the drugs. This skewed prioritization was found to be highly dependent on the prevalence of the diseases whereby medicines for the more prevalent diabetes and cardiovascular diseases were found to have less stock out days.

Essential medicines for non-communicable diseases with the highest stock out rates were mainly anti-cancer medicines. Out of the five facilities studied only one facility had two anticancer drugs out of the thirty-one drug listed on the Kenya Essential Drug List of 2016. Of the two medicines only one was meant for treatment of cancer as the other medicine is used for pain control in palliative management. This resonated to a study done in Vietnam which found that health facilities had just one medicine used for palliative care and no other medicine for cancer management was available (David, 2019).

Various factors were explored to explain the difference in the stock out rate. The high stock out rate of anticancer medicines was attributed to the fact that the disease was still

being viewed as a relatively new pandemic with the Kenya Medical Supplies Authority (KEMSA) having not yet began distributing these cancer drugs to these health facilities. Also lack of expertise on the same. Medicines and related products for management of cancer are required to be handled by highly specialized personal due to the potential harm they pose to both the patient and the healthcare provider There was no single facility that had an oncologist or oncology nurse. However, the Kitale County Referral Hospital had an oncology pharmacist.

Among the reasons for the high stock out rates was poor financing by the county government and the long procurement processes involved in medicines purchase. This resonated to a study by Mwathi and Osuga of 2014 where they found out that there was significant relationship between funding and availability of essential medicines. Low order rates with the county doing only two quarterly orders per year instead of the normal four quarterly orders, implying an order rate of 50% was also found to be contributing to the high stock out rate. These findings resonated to those of a study done in Embu County where the county also had a 50% order rate. Other reasons cited were the long and bureaucratic procurement processes.

The study found that majority of the participants at 71% felt that the county government was not doing enough to ensure steady supply of the essential medicines for non-communicable diseases. Essential medicines were more available when the county government had purchased the medicines and delivered them to the facilities. This happened twice in the year especially at the second and the fourth quarters of the financial year when funds for the main and supplementary budget had been released.

### **5.2.3 Affordability of essential medicines for non-communicable diseases**

The study found that the medicines for non-communicable diseases were affordable in reference to the minimum daily wage of the lowest paid unskilled government employee. The mean affordability was 0.309 days' wages which is affordable according to the world health organization which defines the use of one day's wages on purchase of medicines as being affordable (WHO, 2004). This is in agreement to a health facility survey done by the ministry of health Kenya in 2009 which found the essential medicines in health facilities to be affordable at 0.4 days' wages (MOH, 2009).

However, it is important to note that the affordability only refers to that of one drug and not the cost of obtaining care for the disease in question such as laboratory examination, nutritional supplementation/modification and rehabilitative services. The management of non-communicable diseases involves the use of multi drug therapy as the diseases also come with comorbidities. This therefore means that even though a single medicine may appear affordable the combined cost of the drugs used may not be affordable as reported in this study.

The World Health Organization does not give a specific figure as cut off mark for affordability based on minimum wage. However, it describes use of several days' wages on medicines as being unaffordable (WHO, 2014).

Affordability of cancer drugs could not be calculated due to the fact that the medicines were completely unavailable and the hospitals visited did not have any records on the same including the prices. Therefore, the availability of 0.309 days' wages obtained was

not inclusive of the cancer drugs. The two cancer drugs that were available were given out to the patients for free. This was due to collaboration of the Kitale County Referral Hospital and the Kenya Hospice Society that donated these medicines to the hospital

The results further found that the medicines used for management of chronic obstructive pulmonary disease had the highest affordability ratio of 0.449 days' wages. This is because these medicines have less range of generics in the market compared to the medicines for management of diabetes and cardio vascular diseases which have a wide variety of generics mainly due to the forces of demand and supply (MOH, 2015b) as chronic obstructive pulmonary diseases are less prevalent at 2%. However, the affordability of each medicine in each facility was not so different This was due to the close similarity of the prices per dose of the medicines as set in the hospitals. by the ministry of health.

The study established that only 33% of the participants had any form of insurance mainly National hospital insurance fund (NHIF). The low uptake could be contributed by lack of awareness amongst the patients about the importance of the NHIF considering that majority (44%) of participants had only primary level of education. This poor uptake of NHIF could also be attributed to the high poverty levels in the region. The lack of insurance therefore pushes the patients to spend out of the pocket which is more expensive.

Also, important to note is the fact that Kenya has a very high rate of unemployment at 9.8% (World Bank, 2018) and many more people working in the informal sector. This means that this population earns a daily wage that is less than the lowest paid government

worker. The poverty level of Trans Nzoia County is also known to be high at 50% implying that about half of the population in the county only have one dollar for daily spending. This therefore means that treatment that could appear affordable may be so costly to a very big population in the county.

The study found that the monthly doses of a single medicine to cost less than a day's daily wage. In a study done in six low and medium income countries including Malawi, Pakistan and Nepal, a monotherapy was found to be affordable for a monthly dose at a one day's wage. Drugs used to manage diabetes such as Metformin and glibenclamide tablets were found to cost less than a day's wage. However, the same study showed that insulin70/30, a drug commonly used by diabetes patients cost more than several days' wages. This implies that the cost of insulin 70/30 still stands as one of the most unaffordable no-communicable diseases essential medicine in most low and medium income countries (Mendis, 2007). This is in agreement with this study where metformin and glibenclamide was found to have an affordability of 0.464 and 0.256 days' wages respectively which are less than a one day's wage and insulin 70/30 found to be the second most unaffordable essential medicine after carvedilol tablets. However, our study showed that one still required less than a day's wage to purchase the medicine which implies that the cost is still not beyond reach.

The key informants interviewed reiterated this where majority were of the opinion that it was not really about the cost of the medicines. In fact, they said that these medicines were highly subsidized by the government. However, the population that lived around these

health facilities was too poor and only depended on subsistence farming. Therefore, however less costly the medicine appeared, it was still unaffordable to them.

For patients who require multiple medications for best care then the monthly dose cost may be equivalent to several days' wages hence unaffordable. A good proportion of people living in low and medium income countries earn less than the wages of the lowest paid government worker and live within less than a dollar per day (WHO, 2003).

On the contrary self-report of participants found out that most participants felt that the prices of drugs at the facilities were unaffordable. Only 20% said that the essential medicines were affordable to them

### **5.3 Physical accessibility of essential medicines for non-communicable diseases**

The study found that the health facilities where the participants were to obtain the essential medicines for non-communicable diseases were geographically reachable with most participants at 92% using less than an hour to get to the facility. The World Health Organization recommends that for a health facility to be said to be physically accessible then the patient should use utmost an hour to arrive to the facility (WHO, 2014). However, 52% of the participants complained of poor road network especially on rainy seasons where even the most common means of transport which is the motorcycle found it difficult to use the roads. This forces the patients to at time push forward their clinic dates as they waited for the roads to dry up and be rendered passable. This negatively impacts on their adherence to their medicines as they are forced to do without medicines for some days. Alternatively, they were forced to purchase the medicines at the nearby

private drug stores that are more expensive. The poor road network is a known impediment to healthcare access in low and medium income countries (WHO, 2009).

The study found out that walking was the main means that was used to arrive to the facility at 47%. This was attributed to the fact that most participants came from the nearby villages and therefore the distance covered was not so huge. The use of vehicles was found to be the least popular at 8%. This could be explained by the fact that the road network is poor making it difficult for the public vehicle transport to thrive. The poverty level of the community could also act as hindrance for inventors to put up public vehicle transport. Motorcycle was the most popular vessel of transport with 32% of the participants having reported to have used this means. This is because the motorcycles are more flexible in accessing these impassable roads and also due to their popularity amongst the youth in most communities.

Assessment of the road network from the participants found that 52% of the participants thought that the road network was poor. Those who said that the road network is good were influenced by thoughts of contentment as some reported that the roads have been like that for long and there seems to be no action at hand.

The study found that 0.52 days' wages of lowest paid unskilled government worker was used to access the health facilities. This according to a study done by the ministry of health in Kenya was unaffordable, as the study concluded that use of 0.41 daily wage for travel to access healthcare was found to be high posing a question of how geographically

accessible is healthcare services and in this regard medicines for non-communicable diseases (MOH, 2009).

Different methodologies have been used by different researchers to study accessibility of essential medicines. Few have been done on essential medicines for non-communicable diseases therefore making comparisons is quite difficult. However, most studies have shown that availability of essential medicines in public health sector is low (MOH, 2009). The study shows no significant change in the findings four years after the complete devolution of the health services. This study has provided some insight into the issues related to availability, affordability and physical access of essential medicines for non-communicable diseases in the devolved system. The results are however limited by the fact that the data was subjected to external factors such as delivery schedules. However, the study still highlights priority areas for attention by the county government and the ministry of health. A dialogue is needed to identify the best way possible to improve access to affordable essential medicines for non-communicable diseases.

## **CHAPTER SIX**

### **CONCLUSIONS AND RECOMMENDATIONS**

#### **6.1 Introduction**

There is an epidemiological change in the low and medium income countries including Kenya from a predominance of communicable diseases to that of non-communicable diseases. As the burden of disease in Kenya now includes both communicable and non-communicable diseases, there is need for renewed focus on access to essential medicines for these conditions as reflected by the formation of division of non-communicable disease division in the ministry of health. Successful management of non-communicable diseases requires a reliable supply of affordable medicines. Lack of this will lead to an increase in morbidity and mortality.

#### **6.2 Conclusion**

##### **6.2.1 Availability of essential medicines for non-communicable diseases**

The study answers the question of availability of essential medicines for non-communicable diseases. The study found that the medicines were poorly available at the health facilities at 23% against the recommended level of 80 %. Stock out rate for essential medicines for non-communicable diseases was found to be high at 202 days per year, which was attributed to poor health care financing by the county government of Trans Nzoia. The medicines were more available in Kitale County Referral Hospital at 38% than in all the other facilities studied. The stock out was found to be highest for

essential medicines for management of cancer at 334 days per year. The order rate was found to be poor at 50%.

### **6.2.2 Affordability of essential medicines for non-communicable diseases**

The study found the essential medicines for non-communicable diseases to be affordable based on the minimum daily wage of lowest paid unskilled government employee calculation at 0.309 days' wages. However, participants self-report showed that they were not affordable with 79% having reported that the medicines were unaffordable. Affordability calculated was based on individual drugs and not for a complete therapy. Medicines for management of chronic obstructive pulmonary disease were found to be most unaffordable at 0.449 days' wages. There was however no difference in affordability of a class of medicines in different hospitals as the price margins was controlled by the government.

### **6.2.3 Physical accessibility of essential medicines for non-communicable diseases**

The study determined the physical accessibility of essential medicines for non-communicable diseases and the outcome was that majority (92%) of participants used less than one hour to arrive at health facilities. This therefore meant that the health facilities are geographically accessible to the population. However, the affordability of transport cost to the facility was found to be 0.52 days' wages which was high rendering the health facilities inaccessible. The main mode of transport to the health facility was found to be by walking with majority (52%) reporting that the road network was poor.

## **6.3 Recommendations**

### **6.3.1 Availability of essential medicines for non-communicable diseases**

The study found that the availability of essential medicines for non-communicable diseases was poor. It therefore recommends that there is need to institute measures that will assist in improving the availability of the essential medicines for non-communicable diseases from 23% to the recommended 80%. This may include increasing healthcare funding for purchase of essential medicines for non-communicable diseases.

There is need to revert to the older system of quarterly orders to improve the order rates from 50% to 100%.

There is need to establish partnerships and collaborations with other agencies such as non-governmental organizations to support in provision of essential medicines that will contribute to achieve strategic development goal 3 and universal access to healthcare.

### **6.3.2 Affordability of essential medicines for non-communicable diseases**

The study found that the medicines for non-communicable diseases were affordable due to government subsidy and therefore recommends that there is need for further subsidization of the prices of these essential medicines for non-communicable diseases or even provide them for free as well as roll out the universal health coverage and health insurance for all.

### **6.3.3 Physical accessibility of essential medicines for non-communicable diseases**

The study found that patients used a lot of money to travel to health facilities and recommends that to further improve physical accessibility there is need to provide essential package for non-communicable diseases at primary healthcare facilities including dispensaries and health centers.

There is also need to hasten the conversion of the impassable roads to all weather road or tarmac roads to ease transport to health facilities.

### **6.4 Policy implication**

Existing policies and procedures should be strengthened to ensure steady and uninterrupted supply of essential medicines for non-communicable diseases to the public health facilities.

### **6.5 Action for further studies**

There is need for further studies that will evaluate and provide a unified criterion, providing cut off points for assessment of affordability which can be used to determine affordability for a complete therapy.

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**APPENDICES**

**Appendix 1: Informed consent**

I. (full name of the KII or patient) .....have read the above information/the whole information has been explained to me by..... (Full name of person taking consent), and have fully understood the information. I have had an opportunity to ask questions and all my questions have been answered to my satisfaction. I have also been informed that there shall be no invasive procedure and that my identity shall not be disclosed, that information I give shall be in confidence and for the good of humanity at large. I understand that I may at any time during the study revoke my consent without any loss or penalty. I also understand that no incentives shall be provided

I consent to be willingly enrolled into the study.

Signature.....date.....

(KII or patient)

Researcher

date

Signature

## Appendix 2: Questionnaires

### County NCD Essential Medicines Accessibility Survey questionnaire.

I am Lucy Lasoi, a student pursuing a master's degree in public health from Masinde Muliro University of Science and Technology and as part of my learning am required to carry out a research.

My research is on accessibility of essential medicines for non-communicable diseases in Trans Nzoia County under the devolved system of government. The purpose of this interview is to get more insight on the above matter considering your position as a user of health services in this hospital. The results obtained are expected to inform policy makers, financiers and even consumers on the correct status of accessibility. This is useful for ensuring effective management of the essential medicines.

I am the only person conducting the study. The results obtained shall be shared with you once the research is completed. Your answers will be very valuable as I carry out my research. This interview will last for only 15 minutes.

Could you be having any questions before we begin?

#### **Section A**

#### **Circle the most appropriate answer(s)**

1. How old are you?

a-18-34 years

b-35-64 years

c->64 years

2. What is your gender?

a-Male

b-Female

3. What is your highest level of Education?

a-Primary

b-Secondary

c-Tertiary

d-Other (specify)

4. What economic activity are you engaged in?

a-Formal employment

b-Self-employment

c-Other (specify)

5. What disease do you suffer from?

a-Cancer

b-Diabetes

c-Hypertension or related disease

d-Asthma or related disease

6. For how long have you suffered from the disease(s) in question 5

7. In your opinion, what is your overall health status at this moment?

- a-Poor
- b-Fair
- c-Good
- d-Excellent

**Section B**

1.Out of all the prescribed essential medicines for NCDs, how many have you gotten today? (Circle the most appropriate answer)

- a-Less than half
- b-Half
- c-More than half
- d-All
- e-None

2. Are there periods when your diseases medicines are more available?

- a Yes
- b No

3. Comment on above answer

4. Are there periods when you do not get your diseases medicines at all?

- a Yes
- c No

Comment on above answer

5. In your understanding, what factors do you think the county government could do to improve availability of your medicines? (circle the most appropriate answer)

- a-Accelerate steps in procurement
- b-Select well stocked suppliers
- c-Institute administrative restrictions such as drug Rationing.
- d-Increase funding for essential medicines
- e-Others (specify)

6. In your own opinion do you think your diseases medicines are affordable at this facility

- a Yes
- b No
- c Don't know
- d If No, why do you think so?

7. In your own opinion, what could lead to high pricing of your diseases medicines.

8. What amount of time did you use to arrive to the health facility?

- a-Less than 30 min
- b-30 mins
- c-1 hour
- d- More than 1 hour

9. What mode of transport did you use to arrive to the hospital

- a-Walking
- b-Bicycle
- c-Motor cycle
- d-Motor vehicle

10. How much did it cost (in Kes) to arrive to this facility

- a-Less than 50 ksh
- b-51-100 ksh
- c-101-200 ksh
- d-More than 200 ksh

10. We have come to the end of the interview; could you have any suggestion on how to improve accessibility of your diseases medicines.

Thank you

## **Appendix 3: Key informant interview guide**

### **County NCD Essential Medicines Accessibility Survey-Key Informant Interview**

I am Lucy Lasoi, a student pursuing a master's degree in public health from Masinde Muliro University of Science and Technology and as part of my learning am required to carry out a research.

My research is on accessibility of essential medicines for non-communicable diseases in Trans Nzoia County under the devolved system of government. The purpose of this interview is to get more insight on the above matter considering your position as a well informed person in this matter. The results obtained are expected to inform policy makers, financiers and even consumers on the correct status of accessibility.

I am the only person conducting the study. The results obtained shall be shared with you once the research is completed. Your knowledge will be very valuable as I carry out my research. This interview will last for only 15 minutes.

Could you be having any questions before we begin?

#### **Section A**

Answer as appropriately as possible.

1. What is your position in this institution?
- 2 How many years of experience in healthcare do you have?
  - a. 1-15
  - b. 16-30
  - c. 31-45

#### **Section B**

1. In your own opinion what factors influence the availability of essential medicines for NCDs. Circle the most appropriate answer (s).

- a-Re-order level practices
- b-Fill rate practices
- c-Stock out rates and frequencies
- d-Lead time estimates
- e-Procurement practices
- f-Healthcare financing
- g-Others (specify)

2. In relation to your response in 1 above what is the single most important factor that influence availability of essential medicines for NCDs.

3. In your own opinion:

3.1 Is the county government doing enough to ensure supply of EM for NCDs?

a-Yes

b-No

c-I don't know

3.2 Explain your answer.

4. In your facility:

4.1 Do you experience frequent stock out of EM for NCDs?

a-Yes

b-No

c-I don't know

4.2 If yes, what could be reasons for stock outs? Rate on a scale of 1-4 whereby:

1 Strongly disagree, 2 Disagree, 3 Agree, 4 strongly agree.

<b>Rating</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
Inadequate funding				
Procurement bureaucracies				
Poor inventory management				

5. Are the EM for NCDs procured directly by the facility?

a-Yes

b-No

6. Are the medicines sold to patients subsidized by the county government? Explain

7. In your own opinion what has been the most important determinant in procurement of EM for NCDs?

- a.-Cost
- b.-Needs
- c.-Political influence
- d.-Finances available
- e.-Country's guidelines
- f.-WHO recommendation
- g.-I don't know
- h.-Other (specify).

8. Does the county have a policy on procurement of essential medicines for NCDs?

- a-Yes
- b-No
- c-I don't know

9. In your own opinion what should be done to ensure steady uninterrupted supply of EM for NCDs

- a-Allocate more resources
- b-Reduce lead times
- c-Increase the fill rates
- d-Streamline procurement/seamless procurement
- e-Placing relevant/competent officers in the line of supply chain
- f-Political good will
- g-Others

10. In your own opinion, is there need to improve availability of the essential medicines for NCDs.

- a-Yes
- b-No
- c- I am not sure

11. In your own opinion do you think the NCD essential medicines are affordable in your facility?

a-Yes

b-No

c- I am not sure

If No explain.

12. In your practice, have you experienced patients at your facility citing cost of the NCD essential medicines being affordable or unaffordable? Explain briefly.

13. In your own opinion is there need to improve affordability of the essential medicines for NCDs.

a-Yes

b-No

c- I am not sure

If yes, what steps should be taken to improve affordability.

14. We have come to the end of our interview. Do you have any additional suggestions on how to improve accessibility of essential medicines for NCDs?

Thank you

## Appendix 4: Observation Checklist

### 4.1: Availability of selected NCD drugs.

Hospital Name : \_\_\_\_\_ Date: \_\_\_\_\_ No of essential medicines \_\_\_\_\_

Essential medicine for NCD	Available on day of visit(Y/N)	Records cover at least six months within the past year	Number of days out of stock.	Number of days under review	Equivalent days out of stock per year
<b>EM</b>		<b>BC</b>	<b>OS</b>	<b>RP</b>	<b>E</b>
Metformin tablets		1	35	180	71
Glibenclamide tablets		1	54	180	110
Insulin 70/30					
Soluble insulin					
Amiloride tablets					
Furosemide tablets					
Hydrochlorothiazide 40 mg tablets					
Spironolactone tablets					
Digoxin tablets					
Carvedilol tablets					
Amlodipine tablets					
Enalapril tablets					

<b>Essential medicine for NCD</b>	<b>Available on day of visit(Y/N)</b>	<b>Records cover at least six months within the past year</b>	<b>Number of days out of stock.</b>	<b>Number of days under review</b>	<b>Equivalent days out of stock per year</b>
<b>EM</b>		<b>BC</b>	<b>OS</b>	<b>RP</b>	<b>E</b>
Hydralazine tablets					
Losartan tablets					
Methyldopa tablets					
Glyceryl trinitrate					
Isosorbide dinitrate					
Lidocaine injection					
Verapamil tablets					
Aspirin 75mg tablets					
Artovastatin 20mg tablets					
Beclomethasone inhaler					
Epinephrine injection					
Salbutamol inhaler/solution					
Bleomycin injection					
Capecitabine tablets					
Carboplatin					

<b>Essential medicine for NCD</b>	<b>Available on day of visit(Y/N)</b>	<b>Records cover at least six months within the past year</b>	<b>Number of days out of stock.</b>	<b>Number of days under review</b>	<b>Equivalent days out of stock per year</b>
<b>EM</b>		<b>BC</b>	<b>OS</b>	<b>RP</b>	<b>E</b>
injection					
Alendronic acid tablets					
Allopurinoltablets					
Asparaginase injection					
Calcium folinate tablets/injection					
Carboplatin injection					
Cyclophosphamide injection					
Cytarabine injection					
Chlorambucil tablets					
Dacarbazine injection					
Morphine solution					
Cisplatin injection					
Dactinomycin injection					
Daunorubicin					

<b>Essential medicine for NCD</b>	<b>Available on day of visit(Y/N)</b>	<b>Records cover at least six months within the past year</b>	<b>Number of days out of stock.</b>	<b>Number of days under review</b>	<b>Equivalent days out of stock per year</b>
<b>EM</b>		<b>BC</b>	<b>OS</b>	<b>RP</b>	<b>E</b>
injection					
Docetaxel injection					
Doxorubicin injection					
Etoposide injection					
Filgrastim injection					
Fluorouracil injection					
Gemcitabine injection					
Hydroxycarbamide capsule					
Ifosfanide injection					
Imatinib tablets					
Irinotecan injection					
Mercaptopurine tablets					
Mephalan tablets					
Mesna tablets					
Methotrexate injection/tablets					

Essential medicine for NCD	Available on day of visit(Y/N)	Records cover at least six months within the past year	Number of days out of stock.	Number of days under review	Equivalent days out of stock per year
<b>EM</b>		<b>BC</b>	<b>OS</b>	<b>RP</b>	<b>E</b>
Oxaliplatin injection					
		<b>Sum</b>			<b>Sum</b>
		Average number of days out of stock = sum of E/sum of BC			
		<p><b>EM-</b> Lists 61 vital EMMS under study.</p> <p><b>BC-</b> Records medicines that have record covering six months or more in the last one year. Yes is denoted by 1 while no is denoted by 0.</p> <p><b>OS-</b> Indicates the number of days each drug was marked zero on bin cards during the last six months under review.</p> <p><b>RP-</b> Indicates the number of days actually studied.</p> <p><b>E-</b> Indicates the number of days the essential medicines would have been out of stock should the review period have been one year.</p>			

#### 4.2: Affordability of selected NCD essential medicines

NCD medicine	Number of units in a dose	Price of one unit	Cost of one dose	Affordability
Metformin tablets				
Glibenclamide tablets				
Insulin 70/30				
Soluble insulin				
Amiloride tablets				
Furosemide tablets				
Hydrochlorothiazide 40 mg tablets				
Spironolactone tablets				
Digoxin tablets				
Carvedilol tablets				
Amlodipinne tablets				
Enalapril tablets				
Hydralazine tablets				
Losartan tablets				
Methyldopa tablets				
Glyceryl trinitrate				
Isosorbide dinitrate				
Lidocaine injection				
Verapamil tablets				

<b>NCD medicine</b>	<b>Number of units in a dose</b>	<b>Price of one unit</b>	<b>Cost of one dose</b>	<b>Affordability</b>
Aspirin 75mg tablets				
Artovastatin 20mg tablets				
Beclomethasone inhaler				
Epinephrine injection				
Salbutamol inhaler/solution				
Bleomycin injection				
Capecitabine tablets				
Carboplatin injection				
Alendronic acid tablets				
Allopurinol tablets				
Asparaginase injection				
Calcium folinate tablets/injection				
Carboplatin injection				
Cyclophosphamide injection				
Cytarabine injection				
Chlorambucil tablets				
Dacarbazine injection				
Morphine solution				
Cisplatin injection				

<b>NCD medicine</b>	<b>Number of units in a dose</b>	<b>Price of one unit</b>	<b>Cost of one dose</b>	<b>Affordability</b>
Dactinomycin injection				
Daunorubicin injection				
Docetaxel injection				
Doxorubicin injection				
Etoposide injection				
Filgrastim injection				
Fluorouracil injection				
Gemcitabine injection				
Hydroxycarbamide capsule				
Ifosfanide injection				
Imatinib tablets				
Irinotecan injection				
Mercaptopurine tablets				
Mephalan tablets				
Mesna tablets				
Methotrexate injection/tablets				
Oxaliplatin injection				
		<b>Sum</b>		

## Appendix 5: Map of Trans Nzoia County

Map 1: Location of Trans Nzoia County in Kenya



Source: Kenya National Bureau of Statistics, 2013



## Appendix 6: Results

### Availability of essential medicine on the day of visit

	N	%
Available on day of visit	N 0	0.0%
	Y 5	100.0%
Metforming tablets		
Available on day of visit	N 5	100.0%
Glibenclamide tablets	Y 0	0.0%
Available on day of visit	N 4	80.0%
insulin 70/30	Y 1	20.0%
Available on day of visit	N 0	0.0%
Soluble Insulin	Y 5	100.0%
Available on day of visit	N 4	80.0%
Amiloride	Y 1	20.0%
Available on day of visit	N 0	0.0%
Furosemide	Y 5	100.0%
Available on day of visit	N 2	40.0%
Hydrochlorothiazide	Y 3	60.0%
Available on day of visit	N 3	60.0%
Spironolactone	Y 2	40.0%
Available on day of visit	N 3	60.0%
Digoxin	Y 2	40.0%
Available on day of visit	N 2	40.0%
Carvedilol tablets	Y 3	60.0%
Available on day of visit	N 0	0.0%
Amlodipinne	Y 5	100.0%
Available on day of visit	N 0	0.0%
Enalapril	Y 5	100.0%
Available on day of visit	N 4	80.0%
Hydralazine	Y 1	20.0%
Available on day of visit	N 3	60.0%
Losartan	Y 2	40.0%
Available on day of visit	N 0	0.0%
Methyldopa	Y 5	100.0%
Available on day of visit	N 5	100.0%
Glyceryl trinitrate	Y 0	0.0%
Available on day of	N 5	100.0%

visit Isosorbide dinitrate	Y	0	0.0%
Available on day of	N	0	0.0%
visit Lidocaine injection	Y	5	100.0%
Available on day of	N	5	100.0%
visit verapamil tablets	Y	0	0.0%
Available on day of	N	0	0.0%
visit Aspirin 75mg	Y	5	100.0%
Available on day of	N	0	0.0%
visit Astovastatin 20mg	Y	5	100.0%
Available on day of	N	3	60.0%
visit Beclomethasone	Y	2	40.0%
Available on day of	N	3	60.0%
visit Epinephrine injection	Y	2	40.0%
Available on day of	N	0	0.0%
visit Salbutamol inhaler	Y	5	100.0%
Available on day of	N	4	80.0%
visit Bleomycin injection	Y	1	20.0%
Available on day of	N	5	100.0%
visit Capecitabine tablets	Y	0	0.0%
Available on day of	N	5	100.0%
visit Carboplatin injection	Y	0	0.0%
Available on day of	N	5	100.0%
visit cyclophosphamide injection	Y	0	0.0%
Available on day of	N	3	60.0%
visit Cytarabine injection	Y	2	40.0%
Available on day of	N	4	100.0%
visit Chlorambucil tablets	Y	0	0.0%
Available on day of	N	4	100.0%
visit Dacarbazine injection	Y	0	0.0%
Available on day of	N	4	100.0%
visit Morphine solution	Y	0	0.0%
Available on day of	N	4	100.0%
visit Cisplatin injection	Y	0	0.0%
Available on day of	N	4	100.0%

visit Dactinomycin injection	Y	0	0.0%
Available on day of visit Daunorubicin injection	N	4	100.0%
	Y	0	0.0%
Available on day of visit Docotexael injection	N	4	100.0%
	Y	0	0.0%
Available on day of visit Doxorubicin injection	N	4	80.0%
	Y	1	20.0%
Available on day of visit Etoposide injection	N	4	100.0%
	Y	0	0.0%
Available on day of visit Filgrastim injection	N	4	100.0%
	Y	0	0.0%
Available on day of visit fluorouracil injection	N	4	100.0%
	Y	0	0.0%
Available on day of visit Gemcitabine injection	N	4	100.0%
	Y	0	0.0%
Available on day of visit Hydroxycarbamide capsule	N	4	100.0%
	Y	0	0.0%
Available on day of visit ifosfanide injection	N	4	100.0%
	Y	0	0.0%
Available on day of visit Imatinib tablets	N	4	100.0%
	Y	0	0.0%
Available on day of visit irinotecan injection	N	4	100.0%
	Y	0	0.0%
Available on day of visit Mercaptopurine tablets	N	4	100.0%
	Y	0	0.0%
Available on day of visit Mephalan tablets	N	4	100.0%
	Y	0	0.0%
Available on day of visit mesna tablets	N	4	100.0%
	Y	0	0.0%
Available on day of visit Methotrexate injection/tablets	N	4	100.0%
	Y	0	0.0%

### Observation schedule of records for NCD medicines covering successive one year

	No		Yes	
	N	%	N	%
Records cover at least six months within the past one-year Metformin tablets	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Glibenclamide tablets	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Insuline 70/30	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Solube insulin	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Amiloride tablets	4	80.0 %	1	20.0%
Records cover at least six months within the past one-year Furosemide tablets	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Hydrochlorothiazide 40mg tablets	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year spironolactone tablets	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Diagoxin tablets	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Carvedilol tablets	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Amlodipinne tablets	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Enalapril tablets	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Hydralazine tablets	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Losartan tablets	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Methyldopa tablets	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Glyceryl trinitrate	4	80.0 %	1	20.0%
Records cover at least six months within the past one-year Isosorbide dinitrate	4	80.0 %	1	20.0%
Records cover at least six months within the past one-year Lidocaine injection	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Verapamil tablets	5	100.0 %	0	0.0%

Records cover at least six months within the past one-year Aspirin 75mg tablets	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Artovastatin 20mg tablets	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Beclomethasone inhaler	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Epinephrine injection	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Salbutamol inhaler	0	0.0 %	5	100.0%
Records cover at least six months within the past one-year Bleomycin injection	5	100.0%	0	0.0%
Records cover at least six months within the past one-year capecitabine tablets	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Carboplatin injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Alendronic acid tablets	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Allupurinol tablets	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Asparaginase injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Calcium folinate tablets	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Carboplatin injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year cyclophosphamide	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Cytarabine injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Chlorambucil tablets	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Dacarbazine injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Morphine solution	3	75.0 %	1	25.0%
Records cover at least six months within the past one-year Cisplatin injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Dactinomycin injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Daunorubicin injection	4	100.0%	0	0.0%

Records cover at least six months within the past one-year Docetaxel injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Doxorubicin injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Etoposide injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Filgrastim injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Fluorouracil injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Gemcitabine injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Hydroxycarbamide injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Ifosfanide injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Imatinib tablets	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Irinotecan injection	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Mercaptopurine tablets	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Mephalan tablets	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Mesna tablets	4	100.0%	0	0.0%
Records cover at least six months within the past one-year Methotrexate injection/tablets	3	75.0%	1	25.0%
Records cover at least six months within the past one-year Oxaliplatin injection	4	100.0%	0	0.0%

**Observation schedule of number of days out of stock of selected NCD medicines.**

	Mean	Maximum	Minimum	Standard Deviation
Number of days out of stock Metformin tablets	0	0	0	0
Number of days out of stock Glibenclamide tablets	0	0	0	0
Number of days out of stock Insulin 70/30	66	180	0	68
Number of days out of stock Solube insulin	18	90	0	40
Number of days out of stock Amiloride tablets	144	180	0	80
Number of days out of stock Furosemide tablets	18	60	0	27
Number of days out of stock Hydrochlorothiazide 40mg tablets	90	180	0	90
Number of days out of stock spironolactone tablets	126	180	0	80
Number of days out of stock Digoxin tablets	108	180	0	99
Number of days out of stock Carvedilol tablets	84	180	0	91
Number of days out of stock Amlodipine tablets	12	60	0	27
Number of days out of stock Enalapril tablets	0	0	0	0
Number of days out of stock Hydralazine tablets	120	180	0	85
Number of days out of stock Losartan tablets	126	180	0	80
Number of days out of stock Methyldopa tablets	36	180	0	80
Number of days out of stock Glyceryl trinitrate	144	180	0	80
Number of days out of stock Isosorbide dinitrate	144	180	0	80
Number of days out of stock Lidocaine injection	3	15	0	7
Number of days out of stock Verapamil tablets	180	180	180	0

Number of days out of stock Aspirin 75mg tablets	12	30	0	16
Number of days out of stock Artovastatin 20mg tablets	30	90	0	42
Number of days out of stock Beclomethasone inhaler	126	180	0	80
Number of days out of stock Epinephrine injection	108	180	0	99
Number of days out of stock Salbutamol inhaler	18	90	0	40
Number of days out of stock Bleomycin injection	144	180	0	80
Number of days out of stock capecitabine tablets	182	189	180	5
Number of days out of stock Carboplatin injection	180	180	180	0
Number of days out of stock Alendronic acid tablets	180	180	180	0
Number of days out of stock Allupurinol tablets	135	180	0	90
Number of days out of stock Asparaginase injection	180	180	180	0
Number of days out of stock Calcium folinate tablets	180	180	180	0
Number of days out of stock Carboplatin injection	180	180	180	0
Number of days out of stock cyclophosphamide	180	180	180	0
Number of days out of stock Cytarabine injection	180	180	180	0
Number of days out of stock Chlorambucil tablets	180	180	180	0
Number of days out of stock Dacarbazine injection	180	180	180	0
Number of days out of stock Morphine solution	135	180	0	90
Number of days out of stock Cisplatin injection	180	180	180	0

Number of days out of stock Dactinomycin injection	180	180	180	0
Number of days out of stock Daunorubicin injection	180	180	180	0
Number of days out of stock Docetaxel injection	180	180	180	0
Number of days out of stock Doxorubicin injection	180	180	180	0
Number of days out of stock Etoposide injection	180	180	180	0
Number of days out of stock Filgrastim injection	180	180	180	0
Number of days out of stock Fluorouracil injection	180	180	180	0
Number of days out of stock Gemcitabine injection	180	180	180	0
Number of days out of stock Hydroxycarbamide injection	180	180	180	0
Number of days out of stock Ifosfamide injection	180	180	180	0
Number of days out of stock Imatinib tablets	180	180	180	0
Number of days out of stock Irinotecan injection	180	180	180	0
Records cover at least six months within the past one year Mercaptopurine tablets	0	0	0	0
Records cover at least six months within the past one year Mephalan tablets	0	0	0	0
Records cover at least six months within the past one year Mesna tablets	0	0	0	0
Records cover at least six months within the past one year Methotrexate injection/tablets	0	1	0	1

**Observation schedule of number of days under review of selected NCD medicines**

	Mean	Maximum	Minimum	Standard Deviation
Number of days under review Metformin tablets	182	189	180	4
Number of days under review Glibenclamide tablets	144	180	0	80
Number of days under review Insuline 70/30	180	180	180	0
Number of days under review Solube insulin	180	180	180	0
Number of days under review Amiloride tablets	180	180	180	0
Number of days under review Furosemide tablets	144	180	0	80
Number of days under review Hydrochlorothiazide 40mg tablets	144	180	0	80
Number of days under review spironolactone tablets	180	180	180	0
Number of days under review Diagoxin tablets	144	180	0	80
Number of days under review Carvedilol tablets	144	180	0	80
Number of days under review Amlodipinne tablets	144	180	0	80
Number of days under review Enalapril tablets	144	180	0	80
Number of days under review Hydralazine tablets	144	180	0	80
Number of days under review Losartan tablets	144	180	0	80
Number of days under review Methyldopa tablets	144	180	0	80
Number of days under review Glyceryl trinitrate	144	180	0	80
Number of days under review Isosorbide dinitrate	144	180	0	80
Number of days under review Lidocaine injection	144	180	0	80
Number of days under review Verapamil tablets	180	180	180	0
Number of days under review Aspirin 75mg tablets	144	180	0	80
Number of days under review Artovastatin 20mg tablets	144	180	0	80
Number of days under review Beclomethasone inhaler	162	180	90	40

Number of days under review Epinephrine injection	144	180	0	80
Number of days under review Salbutamol inhaler	144	180	0	80
Number of days under review Bleomycin injection	144	180	0	80
Number of days under review capecitabine tablets	180.0 0	180.00	180.00	.00
Number of days under review Carboplatin injection	180	180	180	0
Number of days under review Alendronic acid tablets	180	180	180	0
Number of days under review Allupurinol tablets	180	180	180	0
Number of days under review Asparaginase injection	180	180	180	0
Number of days under review Calcium folinate tablets	180	180	180	0
Number of days under review Carboplatin injection	180	180	180	0
Number of days under review cyclophosphamide	180	180	180	0
Number of days under review Cytarabine injection	180	180	180	0
Number of days under review Chlorambucil tablets	180	180	180	0
Number of days under review Dacarbazine injection	180	180	180	0
Number of days under review Morphine solution	180	180	180	0
Number of days under review Cisplatin injection	180	180	180	0
Number of days under review Dactinomycin injection	180	180	180	0
Number of days under review Daunorubicin injection	180	180	180	0
Number of days under review Docetaxel injection	180	180	180	0
Number of days under review Doxorubicin injection	180	180	180	0
Number of days under review Etoposide injection	180	180	180	0

Number of days under review Filgrastim injection	180	180	180	0
Number of days under review Fluorouracil injection	180	180	180	0
Number of days under review Gemcitabine injection	180	180	180	0
Number of days under review Hydroxycarbamide injection	180	180	180	0
Number of days under review Ifosfamide injection	180	180	180	0
Number of days under review Imatinib tablets	180	180	180	0
Number of days under review Irinotecan injection	180	180	180	0
Number of days under review Mercaptopurine tablets	180	180	180	0
Number of days under review Mephalan tablets	180	180	180	0
Number of days under review Mesna tablets	180	180	180	0
Number of days under review Methotrexate injection/tablets	180	180	180	0
Number of days under review Oxaliplatin injection	180	180	180	0

**Observation schedule of equivalent number of days out of stock of selected NCD medicines**

	Mean	Maximum	Minimum	Standard Deviation
Equivalent days out of stock per year Metformin tablets	.00	.00	.00	.00
Equivalent days out of stock per year Glibenclamide tablets	.00	.00	.00	.00
Equivalent days out of stock per year Insuline 70/30	61.00	122.00	.00	61.00
Equivalent days out of stock per year Solube insulin	36.60	183.00	.00	81.84
Equivalent days out of stock per year Amiloride tablets	292.00	365.00	.00	163.23
Equivalent days out of stock per year Furosemide tablets	109.60	365.00	.00	151.47
Equivalent days out of stock per year Hydrochlorothiazide 40mg tablets	109.60	365.00	.00	163.29
Equivalent days out of stock per year spironolactone tablets	255.60	365.00	.00	163.18
Equivalent days out of stock per year Diagonin tablets	219.00	365.00	.00	199.92
Equivalent days out of stock per year Carvedilol tablets	170.40	365.00	.00	184.49
Equivalent days out of stock per year Amlodipinne tablets	24.20	121.00	.00	54.11
Equivalent days out of stock per year Enalapril tablets	.00	.00	.00	.00
Equivalent days out of stock per year Hydralazine tablets	243.40	365.00	.00	172.00
Equivalent days out of stock per year Losartan tablets	219.00	365.00	.00	199.92
Equivalent days out of stock per year Methyldopa tablets	73.00	365.00	.00	163.23
Equivalent days out of stock per year Glyceryl trinitrate	292	365	0	163
Equivalent days out of stock per year Isosorbide dinitrate	292.00	365.00	.00	163.23
Equivalent days out of stock per year Lidocaine injection	6.00	30.00	.00	13.42

Equivalent days out of stock per year Verapamil tablets	292.0 0	365.00	.00	163.23
Equivalent days out of stock per year Aspirin 75mg tablets	85.20	365.00	.00	158.63
Equivalent days out of stock per year Artovastatin 20mg tablets	61.00	183.00	.00	86.27
Equivalent days out of stock per year Beclomethasone inhaler	219.0 0	365.00	.00	199.92
Equivalent days out of stock per year Epinephrine injection	219.0 0	365.00	.00	199.92
Equivalent days out of stock per year Salbutamol inhaler	36.60	183.00	.00	81.84
Equivalent days out of stock per year Bleomycin injection	365.0 0	365.00	365.00	.00
Equivalent days out of stock per year capecitabine tablets	365.0 0	365.00	365.00	.00
Equivalent days out of stock per year Carboplatin injection	365.0 0	365.00	365.00	.00
Equivalent days out of stock per year Alendronic acid tablets	365.0 0	365.00	365.00	.00
Equivalent days out of stock per year Allupurinol tablets	273.7 5	365.00	.00	182.50
Equivalent days out of stock per year Asparaginase injection	365.0 0	365.00	365.00	.00
Equivalent days out of stock per year Calcium folinate tablets	365.0 0	365.00	365.00	.00
Equivalent days out of stock per year Carboplatin injection	365.0 0	365.00	365.00	.00
Equivalent days out of stock per year cyclophosphamide	365.0 0	365.00	365.00	.00
Equivalent days out of stock per year Cytarabine injection	365.0 0	365.00	365.00	.00
Equivalent days out of stock per year Chlorambucil tablets	365.0 0	365.00	365.00	.00
Equivalent days out of stock per year Dacarbazine injection	365	365	365	0
Equivalent days out of stock per year Morphine solution	274	365	0	183
Equivalent days out of stock per year Cisplatin injection	365	365	365	0
Equivalent days out of stock per year Dactinomycin injection	365	365	365	0

Equivalent days out of stock per year Daunorubicin injection	365	365	365	0
Equivalent days out of stock per year Docetaxel injection	365	365	365	0
Equivalent days out of stock per year Doxorubicin injection	365	365	365	0
Equivalent days out of stock per year Etoposide injection	365	365	365	0
Equivalent days out of stock per year Filgrastim injection	365	365	365	0
Equivalent days out of stock per year Fluorouracil injection	365	365	365	0
Equivalent days out of stock per year Gemcitabine injection	365	365	365	0
Equivalent days out of stock per year Hydroxycarbamide injection	365	365	365	0
Equivalent days out of stock per year Ifosfamide injection	365	365	365	0
Equivalent days out of stock per year Imatinib tablets	365	365	365	0
Equivalent days out of stock per year Irinotecan injection	365	365	365	0
Equivalent days out of stock per year Mercaptopurine tablets	365	365	365	0
Equivalent days out of stock per year Mephalan tablets	365	365	365	0
Equivalent days out of stock per year Mesna tablets	365	365	365	0
Equivalent days out of stock per year Methotrexate injection/tablets	183	365	0	211
Equivalent days out of stock per year Oxaliplatin injection	365	365	365	0

**Number of units in a dose of selected NCD medicines**

	Mean	Maximum	Minimum
number of units in a dose metforming tablets	90	90	90
number of units in a dose Glibeclamide tablets	60	60	60
number of units in a dose insulin 70/30	1	1	1
number of units in a dose Furosemide tablets	30	30	30
number of units in a dose hydrochlorothiazide 40mg tablets	15	15	15
number of units in a dose Spironolactone tablets	30	30	30
number of units in a dose Digoxin tablets	15	15	15
number of units in a dose carvedilol tablets	30	30	30
number of units in a dose Amlodipinne tablets	30	30	30
number of units in a dose Enalapril tablets	60	60	60
number of units in a dose Losartan tablets	30	30	30
number of units in a dose Methyldopa tablets	30	30	30
number of units in a dose Aspirin 75mg tablets	30	30	30
number of units in a dose Artovastatin 20mg tablets	30	30	30
number of units in a dose Beclomethasone inhaler	1	1	1
number of units in a dose Epinephrine injection	1	1	1

### Cost of one dose of selected NCD medicine

	Mean	Maximum	Minimum	Standard Deviation
Cost of one dose metforming tablets	138	150	120	16
Cost of one dose Glibeclamide tablets	78	180	50	57
Cost of one dose insulin 70/30	210	250	200	22
Cost of one dose soluble Insulin	20	100	0	45
Cost of one dose Amiloride tablets	0	0	0	.
Cost of one dose Furosemide tablets	40	50	20	14
Cost of one dose hydrochlorothiazide 40mg tablets	46	50	30	9
Cost of one dose Spironolactone tablets	122	150	60	41
Cost of one dose Digoxin tablets	46	50	30	9
Cost of one dose carvedilol tablets	222	300	90	107
Cost of one dose Amlodipinne tablets	134	160	60	42
Cost of one dose Enalapril tablets	110	150	0	65
Cost of one dose Hydralazine tablets	98	240	50	95
Cost of one dose Losartan tablets	140	150	100	22
Cost of one dose Methyldopa tablets	88	100	50	25
Cost of one dose isosorbide dinitrate	60	60	60	.
Cost of one dose Lidocaine injection	5	20	0	10
Cost of one dose Verapamil tablets	30	60	0	42

Cost of one dose Aspirin 75mg tablets	140	300	100	89
Cost of one dose Artovastatin 20mg tablets	200	300	100	71
Cost of one dose Beclomethasone inhaler	170	200	50	67
Cost of one dose Epinephrine injection	72	200	10	74
Cost of one dose salbutamol inhaler	200	200	200	0

**Observation checklist of affordability of selected NCD medicine.**

	Mean	Maximum	Minimum	Standard Deviation
Affordability metforming tablets	.464	.510	.400	.059
Affordability Glibeclamide tablets	.256	.610	.130	.199
Affordability insulin 70/30	.604	.840	.170	.254
Affordability soluble Insulin	.068	.340	.000	.152
Affordability Amiloride tablets	.000	.000	.000	.000
Affordability Furosemide tablets	.136	.170	.070	.048
Affordability hydrochlorothiazide 40mg tablets	.156	.170	.100	.031
Affordability Spironolactone tablets	.410	.510	.200	.137
Affordability Digoxin tablets	.156	.170	.100	.031
Affordability carvedilol tablets	.748	1.020	.300	.365
Affordability Amlodipinne tablets	.452	.540	.200	.142
Affordability Enalapril tablets	.372	.510	.000	.220
Affordability Hydralazine tablets	.330	.810	.170	.320
Affordability Losartan tablets	.384	.510	.050	.201
Affordability Methyldopa tablets	.238	.340	.000	.152
Affordability Glyceryl trinitrate	.000	.000	.000	.000
Affordability isosorbide dinitrate	.067	.200	.000	.115
Affordability Lidocaine injection	.014	.070	.000	.031
Affordability Verapamil tablets	.067	.200	.000	.115
Affordability Aspirin 75mg tablets	.474	1.010	.340	.300

Affordability Artovastatin 20mg tablets	.672	1.010	.340	.237
Affordability Beclomethasone inhaler	.570	.670	.170	.224
Affordability Epinephrine injection	.242	.670	.030	.247
Affordability salbutamol inhaler	.536	.670	.000	.300

**Appendix 7: NACOSTI Research Authorization.**



**NATIONAL COMMISSION FOR SCIENCE,  
TECHNOLOGY AND INNOVATION**

Telephone: +254-20-2213471,  
2241349, 3510571, 2219420  
Fax: +254-20-318245, 318249  
Email: dg@nacosti.go.ke  
Website: www.nacosti.go.ke  
When replying please quote

NACOSTI, Upper Kabete  
Off Waiyaki Way  
P.O. Box 30623-00100  
NAIROBI-KENYA

Ref No. **NACOSTI/P/19/38519/31639** Date: **14<sup>th</sup> August, 2019**

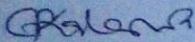
Dr. Lucy Lasoi Saiyoki  
Masinde Muliro University of Science  
And Technology  
P.O. Box 190-50100  
**KAKAMEGA.**

**RE: RESEARCH AUTHORIZATION**

Following your application for authority to carry out research on *“Accessibility of essential medicines for non-communicable diseases in a devolved system of government in Trans-Nzoia County.”* I am pleased to inform you that you have been authorized to undertake research in **Trans Nzoia County** for the period ending **13<sup>th</sup> August, 2020.**

You are advised to report to **the County Commissioner, the County Director of Health Services, and the County Director of Education, Trans Nzoia County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit a copy of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

  
**GODFREY P. KALERWA., MSc, MBA, MKIM**  
**FOR: DIRECTOR-GENERAL/CEO**

Copy to:

The County Commissioner  
Trans Nzoia County.

The County Director of Education  
Trans Nzoia County.

National Commission for Science, Technology and Innovation is ISO9001:2008 Certified

**Appendix 8: County Government Research Authorization.**

REPUBLIC OF KENYA



COUNTY GOVERNMENT OF TRANS NZOIA  
STATE DEPARTMENT OF HEALTH  
HEALTH CORPORATE SERVICES

Office of the Director (H.C.S.)  
health-corporate-services@outlook.com

P.O. Box 4211-30200, Kitale  
Tel: +254-722-540-959

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7<sup>th</sup> June, 2019

To: Dr. Lucy Lasol Salyoki,  
Masinde Muliro University of Science and Technology,  
P.O. Box 190 – 50100,  
Kakamega,  
Kakamega County.

Dear Madam,

**RE: RESEARCH AUTHORIZATION**

Following your application for authority to carry out research on the topic “*Accessibility of Essential Medicines for Non-Communicable Diseases in a Devolved System of Government in Trans Nzola County*” at Kitale County Referral Hospital, Saboti Sub County Hospital, Kapsara Sub County Hospital, Kwanza Sub County Hospital and Endebess Sub County Hospital; I am pleased to inform you that the authority is hereby granted.

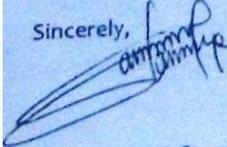
Please note that the authority granted is only administrative and is subject to the following requirements:

- i. Approval from a competent Institutional Ethics Review Committee (IERC);
- ii. Approval from the National Commission for Science, Technology and Innovation (where applicable);
- iii. Approval from the health facility at which the research is to be conducted (the host institution).

Please ensure that your research is conducted within the time stipulated in your application. Any extensions shall require fresh endorsement.

With Best Wishes.

Sincerely,



Dr. Masibo W. Sammy,  
Director - Health Corporate Services,  
County Government of Trans Nzola.

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Vision: A Healthy and Nationally Competitive County

## Appendix 9: MMUST IERC Research Authorization.

  
MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY  
P. O. Box 190-50100  
Kakamega, Kenya

Tel: 056-31375  
Fax: 056-30153  
E-mail: [ierc@mmust.ac.ke](mailto:ierc@mmust.ac.ke)  
Website: [www.mmust.ac.ke](http://www.mmust.ac.ke)

Institutional Ethics Review Committee (IERC)

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Ref: MMU/COR: 403012 vol2 (18) Date: 6<sup>th</sup> June, 2019

Lucy Lasoi Saiyoki  
Masinde Muliro University of Science and Technology  
P.O. Box 190-50100  
KAKAMEGA

Dear Ms. Lasoi

**RE: Accessibility of essential medicines for non-communicable diseases in a devolved system of government in Trans-Nzoia county - MMUST/IERC/31/19**

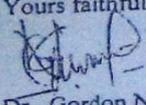
Thank you for submitting your proposal entitled as above for initial review. This is to inform you, that the committee conducted the initial review and approved (with minor changes) the above Referenced application for one year.

This approval is valid from 6<sup>th</sup> June, 2019 through to 6<sup>th</sup> June, 2020. Please note that authorization to conduct this study will automatically expire on 6<sup>th</sup> June, 2020. If you plan to continue with data collection or analysis beyond this date please submit an application for continuing approval to the MMUST IERC by 6<sup>th</sup> May, 2020.

Approval for continuation of the study will be subject to submission and review of an annual report that must reach the MMUST IERC secretariat by 6<sup>th</sup> May, 2020. You are required to submit any amendments to this protocol and any other information pertinent to human participation in this study to MMUST IERC prior to implementation.

Please note that any unanticipated problems or adverse effects/events resulting from the conduct of this study must be reported to MMUST IERC. Also note that you are required to seek for research permit from NACOSTI prior to the initiation of the study.

Yours faithfully,

  
Dr. Gordon Nguka (PhD)  
Chairman, Institutional Ethics Review Committee

Copy to:

- The Secretary, National Bio-Ethics Committee
- Vice Chancellor
- DVC (PR&I)
- DVC (A & F)

## Appendix 10: NACOSTI PERMIT

THIS IS TO CERTIFY THAT:  
**DR. LUCY LASOI SAIYOKI**  
of MASINDE MULIRO UNIVERSITY OF  
SCIENCE & TECHNOLOGY, 0-30200  
KITALE, has been permitted to conduct  
research in *Transnzoia County*

Permit No : NACOSTI/P/19/38519/31639  
Date Of Issue : 14th August, 2019  
Fee Recieved : Ksh 1000

on the topic: **ACCESSIBILITY OF  
ESSENTIAL MEDICINES FOR  
NON-COMMUNICABLE DISEASES IN A  
DEVOLVED SYSTEM OF GOVERNMENT IN  
TRANS-NZOIA COUNTY.**

for the period ending:  
**13th August, 2020**

  
.....  
**Applicant's  
Signature**



  
.....  
**Director General  
National Commission for Science,  
Technology & Innovation**

THE SCIENCE, TECHNOLOGY AND  
INNOVATION ACT, 2013

The Grant of Research Licenses is guided by the Science,  
Technology and Innovation (Research Licensing) Regulations, 2014.

**CONDITIONS**

1. The License is valid for the proposed research, location and specified period.
2. The License and any rights thereunder are non-transferable.
3. The Licensee shall inform the County Governor before commencement of the research.
4. Excavation, filming and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
5. The License does not give authority to transfer research materials.
6. NACOSTI may monitor and evaluate the licensed research project.
7. The Licensee shall submit one hard copy and upload a soft copy of their final report within one year of completion of the research.
8. NACOSTI reserves the right to modify the conditions of the License including cancellation without prior notice.

National Commission for Science, Technology and innovation  
P.O. Box 30623 - 00100, Nairobi, Kenya  
TEL: 020 400 7000, 0713 788787, 0735 404245  
Email: dg@nacosti.go.ke, registry@nacosti.go.ke  
Website: www.nacosti.go.ke

  
**REPUBLIC OF KENYA**

  
**National Commission for Science,  
Technology and Innovation**

**RESEARCH LICENSE**

Serial-No.A 26322  
CONDITIONS: see back page