EFFECT OF MALARIA AILMENT ON LABOUR EMPLOYMENT PROBABILITY AND COST IMPLICATIONS IN NIGERIA

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A Thesis in the Department of Economics, Submitted to the Faculty of the Social Sciences in partial fulfilment of the requirements for the Degree of

DOCTOR OF PHILOSOPHY

of the

UNIVERSITY OF IBADAN

JUNE 2016

ABSTRACT

Malaria incidence threatens human existence and reduces economic prospects in countries with high prevalence. Physical challenges caused by malaria can be a limitation to employment probability in the labour market. The co-existence of malaria with high rate of poverty in Nigeria has implications on income loss. While the direct (treatment) and indirect (productivity loss) cost burden of malaria in relation to Gross Domestic Product (GDP) has been examined in Nigeria, its effects on labour employment and income lost to treatment (direct cost) have received little attention. This study, therefore, examined the effect of malaria on employment probability and estimated the cost burden of the illness in terms of income loss.

A neoclassical labour supply framework that considered time lost by labour to search for job due to morbidity from malaria was applied. A binary probit model was used to determine the effect of malaria on employment probability. Other factors (age, place of residence, level of educational attainment and gender) that influence the chance of being employed in the labour market were also considered in the model. Data were collected from the *2010 Harmonised Nigerian Living Standard Survey*, conducted by the National Bureau of Statistics. Statistical significance was determined at $p < 0.05$. Direct costs were computed using a bottom up approach that summed up the expenditure components (transportation, physician consultation, hospitalisation and drug) of malaria treatment. Income lost to treatment was examined based on the fraction of monthly per capita household income expended as direct cost. This was determined as the ratio of average treatment cost to monthly per capita income earned. Loss in income as indirect cost was determined using the human capital approach that identified persons employed who lost work days due to malaria ailment. An estimate of total income loss in aggregate output was computed as the proportion of total direct and indirect cost in GDP.

Malaria ailment significantly reduced employment probability by 78.0% mainly due to inability of labour to search for job while ill. The probability of being employed increased with rise in age between 15-64 years (β=0.01) and urban residency (β=0.07). Employment likelihood fell with increased educational attainment (secondary β= -0.03, tertiary β= -0.04), due to dominance of the informal sector. Males were 6.0% less likely to be employed than females. On average, an individual spent ₦2, 730 (transportation ₦470, physician consultation ₦810, hospitalisation ₦530 and drug ₦920) as direct cost (treatment) for an incidence of malaria. This meant that household expenditure for an episode of malaria treatment represented 3% of monthly per capita household income (₦91, 000). Indirect cost per incidence of malaria was N34, 040 and ₦25, 540 for the malaria patient and the caregiver respectively. The total estimated income lost per annum to malaria attack was ₦1, 906 billion which accounted for 8% of GDP.

Malaria ailment reduced employment probability and imposed a huge burden on the economy. Effectively tackling malaria should be prioritized in order to enhance labour employment probability and increase output.

Keywords: Malaria ailment, Employment probability, Labour market in Nigeria, Cost implication

Word count: 491

ACKNOWLEDGEMENT

I give thanks to God Almighty for the privilege and grace to complete this programme. There were times I felt confused; like in a quagmire; he answered my prayers at the nick of time and his help was undoubtedly evident.

I sincerely appreciate the chairman of my thesis committee, Dr David Lawanson. Over the years, I have learnt from you not only academic and research skills; but also developed self-confidence and attention to details. Your support, positive pressure and encouragement had invaluable impact on completion of this research. God bless you sir.

With great pleasure, I acknowledge Professor Olaniyan; a member of my thesis committee. Your depth of knowledge has given deeper insight to this thesis. God bless you sir.

I thank Dr Ogun, Professor Eghwaikhide, Dr Adewuyi, Professor Ogunkola, Dr Tosin, Dr Sam, Professor Femi Ayadi and others too numerous to mention. The immense contributions you gave to the success of my academic pursuit are priceless.

For saying 'yes' to my pursuing this programme, enduring the times I was away, giving me unwavering support and encouragement in every dimension, I want to say thank you to my loving husband, Joshua Osakede. This journey would have been very uneasy without your prayers and sturdy support.

To my sweet angels Peace and Prince Joshua I am grateful; you both understood, showed patience and endurance while mummy had to study and be away sometimes in pursuing this goal. To Sarah Job, I say thank you for the willingness to accompany me to Ibadan and take care of the kids during the first year of my study. Your presence brought a huge relief to the pressure of combining home keeping with schooling.

I am also deeply grateful to my mum, Mrs Suzzy Abamba. You stood by me and gave full assistance to take care of the kids. God has helped me through your presence to give me ease on this journey; the God I serve will indeed bless you mama. To my siblings: Fakus, Ify, Sunny, Neku, Chichi, Nene, Ekene and Obi, thank you all for your words of encouragement and for been there whenever I needed help.

To my wonderful colleagues who showed much concern and love all the way I say thank you; Dr Noah Olasehinde Jacob Novignon, Eric Arthur, Bose, Solomon Olakojo, Dayo Olanikpekun, Gbenga Sanusi, Mr Falayi, Rifkatu, Saheed, Yemisi, Winnie, Bupe and many others. I hope and pray we continue to look out for each other even after here.

Dr Ojebode and Mr Teh, words are not enough to thank you for standing by me right from my master degree programme through to the fulfilment of this dream. You too will find help when you need one. God bless you greatly.

Finally, I truly appreciate the African Economic Research Consortium (AERC), for the financial support and exposure through the beginning to completion of this programme. I pray that God will continue to strengthen and uphold the vision of the AERC in achieving Human capital development in Africa. With all sense of gratitude I say *asante sana.*

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CERTIFICATION

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DEDICATION

To my parents, Christopher (late) and Suzzy Abamba

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

Regional analysis of illness shows higher burden[1] in Africa particularly Sub-Saharan Africa (SSA) along with poor countries in Asia and Latin America than other regions of the world (WHO, 2004; World Bank, 2013). The SSA region constitutes about 12 % of world population and records approximately 20 % of global deaths from diseases. This compares unfavourably with high income countries which have 15 % of world population and 13 % of global mortality records from illnesses (WHO, 2004).

There are three broad categories provided by the World Health Organisation (WHO) for illnesses in the globe. These categories are; communicable, non-communicable illnesses and injuries. Poor health conditions in SSA are commonly identified with communicable diseases (WHO, 2004; World Bank, 2013). Particular illness conditions among the group of communicable diseases, such as the Human Immuno-Deficiency Virus /Acquired Immune Deficiency Syndrome ((HIV)/AIDS), tuberculosis and malaria are branded with higher detrimental effects on economic advancement in the region. Recognition of the hazardous effects of these illnesses motivated policy actions to curb these ailments by their inclusion in the Millenium Development goals (MDGs)

[1] The burden of illness refers to the impact of health problem as measured by financial cost, mortality, morbidity or other indicators. It is also commonly quantified as the years of life lost due to illness (YLD). The years of life lost is the gap between current health status and the ideal health status where the individual lives to old age free from disease and disability (Pruss-Ustun and Corvalian,2006; Kay *et al* 2003; Pruss-Ustun *et al* 2000)

and the recent Sustainable Development goals (SDGs)[2]. Despite national and international strategies to control these illnesses, their prevalence, especially of malaria, continues to hamper economic progress in the region.

Global health figures shows that the Nigeria economy records highest population vulnerability to malaria. The country ranks first among nations with high burden from malaria (WHO, 2012). As is the case with malaria prone areas, poor health conditions induced by the illness have been recognised in terms of high mortality rates especially for infants, pregnant women and nursing mothers (CSLAC, 2012). In Nigeria, approximately 300,000 children die from malaria per year with maternal mortality figures as high as about 11% (UNICEF, 2010). In terms of economic advancement, the effect of malaria in Nigeria had been considered with reference to treatment cost burden and productivity losses. However, empirical assessment of the illness in relation to its effect on labour market outcomes is yet to be explored. This relates with physical incapacitation which can set a limit to the extent of labour effort to search for work or take advantage of job opportunities. This nexus along with the notably high prevalence and morbidity associated with malaria in Nigeria motivates examination of the effect of the illness on labour employment probability. An exploration of this relationship further rests on the highly labour intensive method of production in Nigeria requiring physical effort for labour engagement in work activities. Following arguments that the Nigerian labour market is one source of risk through which poverty pervades the economy; determination of malaria effect on the Nigerian labour force also becomes necessary to ascertain the welfare implication and role of the illness in developmental prospects (Ogwumike, 2002).

[2] The SDGs are post MDGs. They are an extension of the MDG beyond the year 2015. The essence is to complete what could not be achieved by the MDG as at the target year 2015. They comprise a set of 17 goals with 169 targets. The main resolve is to shift the world into sustainable development with an overall intent to eradicate poverty in all its forms and dimensions. ICSU, ISSC (2015)

The high vulnerability of the Nigerian populace to malaria increases not only the susceptibility to the disease but also endangers the population health in experiencing recurring incidence of the illness. Individuals derive satisfaction from good health; hence continual reduction in health stock due to recurrent episodes of malaria compels steady health care spending in terms of treatment costs. This has unfavourable implications for individual and household budgetary allocations as well as welfare improvements. Household welfare is also at risk with the coexistence of malaria along with high poverty and towering out of pocket payments for healthcare in Nigeria (NBS, 2012; Soyibo, 2005; Soyibo *et al* 2009). In an attempt to explore malaria effect on the Nigerian economy, this study sought to determine its impact not only on labour outcome[3] especially in relation to the probability of labour employment, but also examine the cost burden associated with the illness in Nigeria.

1.2 Problem Statement

Malaria is generally seen as a threat to human existence and regardless of efforts to mitigate its impact, prevalence remains high in some parts of the world especially in African economies (WEF, 2006). Global analysis of reported cases of malaria shows that the African continent is most susceptible to the illness with records of approximately 90% of the total world malaria cases (UNECA, 2011). The high incidence of malaria in African weighs heavily on health systems in the region and also constitutes a problem to economic performance (WEF, 2006). Devastating effects of the illness are commonly highlighted with increasing poverty and inequality, raising illness burden, and reduced opportunities for economic expansion.

[3] Labour Market outcome has been conceptualised as the status of the labour force in different dimensions; in terms of proportion of persons employed or unemployed, work hours or days supplied and proportion of persons out of the labour force. See for instance Wilkins, 2002; Bridges and Lawson, 2008, Machio 2012.

Individuals who live in malaria endemic areas often experience re-occurrence of the illness even after effective treatment. Such persons are therefore compelled to engage in repeated treatment measures for as much time as they reside in areas that are prone to the disease. This unambiguously imposes a huge burden on household income particularly for persons who are poor. The vulnerability of persons who reside in areas where malaria is ubiquitous is not only observable in terms of treatment burden but also in connection with a reduction in productive labour time. This threatens the productivity of labour and hence income earnings. The co-existence of the illness in African economies which are highly informal along with high poverty rate further aggravates the effect of the illness in terms of income lost to treatment and earning prospects of the labour force. An extension of this effect can be related to a fall in individual and household budgetary allocation to other basic needs which could further worsen health status.

Malaria symptoms commonly induce physical incapacitation which can become a challenge to labour effort to search and take advantage of job opportunities. In line with the argument that labour employment or participation in the labour market provides inclinations to earnings and income inequality, the effect of malaria on manpower proposes that it has possible consequences on employment status and hence determines individual and household income and welfare (Ogwumike *et al* 2010).

Aside from reduction in income prospects, the illness further predisposes persons who reside in highly susceptible areas to other diseases. For instance, Hong (2013) had shown that individuals who live in malaria endemic areas are vulnerable to contracting chronic illnesses such as cardiovascular diseases, respiratory problems and Hernia. This after effect of malaria infection becomes obvious as the individual grows older. Aside from the risk of exposure to chronic ailments, anaemic conditions induced by the disease sometimes requires blood transfusion which increases the risk of infection with the HIV/AIDS virus (Snow *et al* 1999; WEF, 2006). Blood transfusion due to

anaemic conditions from malaria also promotes risks of contracting other lethal infections such as the Hepatitis B and C. (WEF, 2006). The connotation therefore is that malaria particularly in holo-endemic areas intensifies the burden of illness for both communicable and non-communicable diseases.

Gallup and Sachs (2001) and Asante (2003) had earlier described malaria as both a cause and consequence of poverty. This is particularly in relation to high prevalence of the disease in poor regions of the world and induced reduction in prospects for economic expansion. For instance, severe malaria cases such as cerebral malaria, result in some forms of disability or conditions such as hearing impairments, blindness, speech disorders, and weakness of the limbs. (Chima *et al* 2003). These developments have unfavourable implication for future earnings and productivity of labour (Boissier *et al* 1985; Knight and Sabot, 1990). On the other hand, the low income status in such areas limits the ability to muster sufficient resources to curb the prevalence and detrimental effects of the illness.

In terms of specific production sector effects of the illness, malaria is recognized as a factor that influences the extent of land use and choice of crop cultivation in the agricultural sector. Regular reoccurrence of the illness particularly for persons in the agricultural sector induce preference for the cultivation of crops requiring less effort (Conly, 1975; Sachs and Melaney, 2002). The illness can hence be associated with the variety of crops produced in the domestic economy. Effects of malaria on the extent and productive use of land for agricultural activities were observed in countries such as Sri Lanka, Sardinia, Greece, Nepal and Corsica, where eradication of the illness resulted to a rise in the productivity of previously unfarmed areas (Brown, 1986).

The high prevalence of the illness in Africa is a core reason for the low advancement in economic prospects of the region relative to other continents of the world. In terms of country specific figures, the Nigerian economy has the highest global population

vulnerability to malaria (WHO, 2012). Approximately 97% of the country's populace is at risk of exposure to malaria parasite. Further evidence from the WHO (2009) shows that in 2006, Nigeria accounted for one in four reported cases of malaria in the WHO African region[4]. Statistics on prevalence of the illness in Nigeria further reveals that about half of the Nigerian adult population experience at least one bout of the illness per year while children under-five years of age have as much as two to four attacks each year (FMOH, 2005; UNICEF, 2010). Statistics from the NBS (2012) show that malaria accounts for over 60% of total reported illnesses in Nigeria. More than 60% of all outpatient visits and 30% of hospitalisation in Nigeria are also related to the illness (UNICEF, 2010). These figures collectively show high burden of malaria in the Nigerian health sector.

The high prevalence of malaria in Nigeria is principally attributed to the country's climate which provides the best combination of rainfall, temperature and humidity that allows for breeding and survival of the Anopheles mosquito[5] (NPC *et al* 2012). The situation is worsened given evidence that of the four species of plasmodium parasite[6] that cause malaria globally, the Plasmodium falciparium specie, which is associated with more severity and death, is the most common in Nigeria (Jamison *et al* 2006; WHO, 2014).

The burden of malaria prevalence in Nigeria is again exacerbated by the fact that the parasite has developed growing resistance to existing line of drugs. This has informed treatment with more expensive Artesimine combination therapy (ACT) (WEF, 2006, Alaba and Alaba 2009). Given that over 60% of the Nigerian populace are poor, the purchase of effective medication will weigh severely on individual and household

[4] The WHO African region refers to the countries with a regional WHO office. There are a total of 47 countries in this region (WHO, 2015)
[5] The Anopheles mosquito is identified as the main transmitter of the plasmodium virus that causes malaria (NPC *et al* 2012, UNECA, 2011)
[6] The other three malaria parasites are P. vivax, P. malariae, and P. ovale (Jamison *et al* 2006)

income as well as budgetary allocations. Individuals who are not able to access adequate treatment would experience further decline in health capital stock concomitant with increased vulnerability to reoccurrence of the illness. Such persons will also experience higher productivity loss due to increased morbidity from the illness. The high cost of treating the illness will induce reductions in savings prospects particularly for poor persons. Low savings rate will again impact unfavourably on economic output. Negative outcome of the illness on GDP also relates unequivocally with detrimental effects on labour contributions to output in terms of productivity losses.

From the foregoing, an examination of the effects of malaria on the Nigerian economy particularly through its impact on labour employment decision will provide insight to welfare effects of the illness. This is in connection with the notion that the fraction of employed persons in the labour force essentially explains income earnings and labour contributions to economic output. More so, outcomes in the labour market largely influence the ability to pay for healthcare. The purpose of this study therefore is to examine the effect of malaria on the probability of labour employment and also provide recent evidence on cost implications of the illness in Nigeria.

1.3 Research Questions

This study thus attempts to provide answers to the following research questions;

i. Does malaria affect labour employment in Nigeria?
ii. By how many days does malaria affect workdays and what is the associated productivity loss?
iii. What is the estimate for treatment cost for an episode of malaria and cost burden in terms of income fraction spent?
iv. What is the cost implication of malaria in Nigeria's economic output?

1.4 Research Objectives

In line with the research questions, the general objective of this study is to examine the effect of malaria on labour employment probability and cost outcomes in Nigeria. Specifically, this study intends to achieve the following objectives:

i. Examine the effect of malaria on employment decisions in Nigeria;
ii. Estimate the number of workdays lost and related productivity loss (indirect cost) due to malaria;
iii. Estimate direct cost and income fraction associated with malaria treatment; and
iv. Determine total cost estimates (direct and indirect) for malaria and fraction of GDP lost to an episode of the illness.

1.5 Justification for the Study

Determining the extent to which employment decisions are influenced by illness among other things is imperative for ensuring better living standards and achieving growth prospects. This follows from arguments that labour and capital are vital to production process. In labour-intensive economies like Nigeria, outcomes in the labour market are considered central to overall economic performance. Examining labour market outcomes in Nigeria is vital with evidence of increasing unemployment statistics in the country along with low returns to labour (NBS, 2012).

In examining the effect of health on labour market outcomes, studies have commonly made use of disabilities or conditions[7] associated with poor health status (Stern, 1989;

[7] Such conditions include hearing impairment, weakness of the hands and limbs, poor sight, speech disorders, mental retardation amongst others (See Stern, 1989; Gannon and Nolan, 2003; Gannon, 2005)

Gannon and Nolan, 2003; Gannon, 2005). Findings from these studies generally indicate inverse relationship between participation decisions and poor health status. Conclusions from these studies only inform policy actions on improving general health status in order to raise labour employments and contribution to output without recourse to the root determinants of such conditions or disability. Policy actions drawn from such findings can only act on a guess of which illness to address to ensure better health status. This draw back has motivated other research work on particular illnesses and their effect on labour market outcomes (Jose, Ravindiran and Abello, 2004; Barnay and Debrand, 2006; Machio, 2012,). However, illnesses that have been examined in relation to output and labour force nexus are particularly in the group of non-communicable diseases. This opens a gap in health economics literature especially for communicable diseases such as malaria; highly prevalent in developing economies and constitutes a threat to income prospects. Findings on malaria effect on labour market prospects particularly in Nigeria will provide some empirical validation to its effect on labour employment decisions and hence give insights to its impact on economic performance.

Malaria effects on economic conditions have been considered by earlier studies with sole focus on cost estimates in relation to the disease (Alaba and Alaba, 2009; Okorosobo *et al* 2011; Jimoh *et al* 2007; Kioko *et al* 2013). Findings from these studies provide useful insight to cost estimates for the treatment of an episode of malaria and productivity loss from the illness. These studies only provide estimates of direct and indirect costs associated with malaria and sometimes relate total costs to GDP. Attempts to provide estimates of income fraction spent as treatment cost or otherwise lost to at least one episode of the illness are not available in economic literature. An examination of cost burden associated with malaria in terms of income loss to treatment will provide insight to an aspect of welfare loss from the illness. Figures for income fraction lost to the illness offer the purview of the burden of

malaria in Nigeria in relation to a case where several individuals in a household have simultaneous experience of the illness. Studies have also generally provided cost estimates for malaria without consideration of variations in cost figures across population groups. The figures of costs across population categories will give evidence to differences in cost burden for each of these groups of individuals. Such finding will enable identification of the population group that suffers most from the illness. This study extends findings on costs in relation to malaria by examining cost outcome for different population groups. The population groupings considered are across employment types, urban and rural areas, income, gender, and geopolitical zones. Extension of malaria effect on employment decisions for each of these groups adds to literature findings on differences in health effect of the illness across population categories.

This study differs from other empirical assessment of malaria impacts in Nigeria with the use of a more representative data set. Empirical findings of the study on malaria effect in Nigeria will provide a better capture of the prevailing impact of the illness in the Nigerian economy. Studies that have examined the effect of Malaria in Nigeria have particularly focused on cost burden with data for just one or a group of states in a particular geopolitical zone due to data limitations (Jimoh *et al* 2007; Alaba and Alaba, 2009; Okorosobo *et al* 2011). This study provides a better capture of malaria effect in Nigeria by using a more comprehensive data set from the Harmonised Nigerian Living Standard Survey (HNLSS). The HNLSS data used in this study provides information on welfare and poverty trend in Nigeria for the thirty-six states of the federation with an extension of the section on health to reported cases of malaria and treatment costs in relation to the illness.

The study further contributes to literature by the inclusion of time lost to illness in the neoclassical theory of labour supply. This slight adjustment of the theory enables the link of illness effect with labour employment decision. This approach distinguishes

leisure time from illness time basically because time spent by individuals to recuperate from illness cannot necessarily be counted as leisure. Further modification to the theory was by introduction of health as well as non-health goods and services consumed instead of the household production for food and non-food goods and services in the individual utility maximizing framework shown by Huffman (2010). The choice of using the individual utility maximizing framework rather than that of the household is basically determined by the study focus on malaria effect on employment decision of the individual rather than the household. The use of an individual utility maximising framework is further justified by the unrealistic nature of having a joint utility maximising framework for all persons in the household. (Stoep, 2008).

1.6 Scope of the Study

This study made use of individuals in the economically active population in determining malaria effect on labour employment and providing mean estimates of cost burden of malaria. Hence individuals in the age group of 15 to 64 years comprise the study sample. Direct and indirect costs associated with this group of persons as a result of malaria provides a better capture of cost figures as income earned from working and effective demand are traceable to the working age group. The study sample for labour market outcome comprised those in the economically active population who had malaria two weeks prior to the HNLSS and those who did not report any form of illness. Mean computations for cost were determined by using only persons in the working age group who had malaria two weeks prior to the survey. With the scale of labour employment as applied in the HNLSS, this study examines labour market outcomes as being employed or not within a week.

1.7 Organisation of the Study

This study comprises six chapters. Following the introductory chapter is chapter two which provides background information to the study. Chapter three encompasses theoretical and empirical literature reviews. Chapter four covers theoretical framework and estimation technique adopted. The study results and discussion of findings are presented in chapter five, while chapter six presents summary of study findings, conclusion, policy recommendations, study limitations and suggestions for future research.

CHAPTER TWO

BACKGROUND

2.1 Introduction

This chapter presents background information on the Nigerian economy. It examines the country in terms of population characteristics, structure of the health sector, funding sources for healthcare, health and disease profile over time as well as labour force participation rate.

2.2 Features of the Nigerian Population

Nigeria is the most populous country in Africa with an estimated population of 178, 516,904 million as at 2014 (WPR, 2014). Percentage distribution of male and female populace is approximately 51.22% and 48.78% respectively. About 39.6% of the population are under the age of 15 and those in the economically active population (15 to 64 years) make up approximately 56.3% of the total population while those who are 65 years and above comprise 4.1% (PRB, 2007; NBS, 2011; NBS, 2012,). The country is characterised with fertility rate of about 6% with more of the populace living in rural

areas (WDI, 2015; ILaah *et al* 2013; NBS, 2010). Figures on poverty profile in the country show that as at 2010, approximately 60% of the Nigerian population lived on less than US $ 1 daily. This implies that more than half of the population are poor (NBS, 2012).

The Nigerian economy maintains a federal system of government with 36 states and the Federal Capital Territory (FCT) Abuja. Each State is further divided into local government areas. Overall, the country is made up of a total of 774 local government areas (LGA's). The country is also subdivided into six geopolitical zones. These are the North-Central, North-East, North-West, South-East, South-South and the South-West. Evidence from the 2006 census figures reveal that more persons reside in the north than southern part of the country. About 53.57% of the masses live in the north while 46.36% live in the southern part of the country.

2.3 Structure of the Nigerian Health System

The Nigerian healthcare system[8] is mainly built on the responsibility of the federal, state and the local government. Each tier of government is responsible for a level of healthcare provision.

The federal government is liable for tertiary healthcare provision. Tertiary healthcare provision includes the creation and management of teaching hospitals as well as federal medical centres. Healthcare provision by the Federal Government is monitored by the Federal Ministry of Health (FMOH), usually headed by the Federal Minster of Health who monitors and evaluates the implementation of national health policy programmes. The FMOH also ensures availability of vaccines, essential drugs, and operation of teaching hospitals, psychiatric hospitals as well as orthopaedic hospitals.

[8] The healthcare system refers to how people, institutions and resources that deliver healthcare services are organised to meet the health needs of a target population.

The FMOH is also concerned with the training of medical doctors, monitoring and control of contagious and communicable diseases (ADB, 2002).

The state government on the other hand is responsible for the provision of secondary health facilities. Secondary healthcare provision basically covers: creation, management and funding of general hospitals. Provision of health facilities by the state government is under the supervision of the State Ministry of Health (SMOH). The SMOH is responsible for operating secondary and non-specialised tertiary hospitals, planning and coordination of state health systems, training nurses, midwives, and auxiliary staff as well as assisting the LGA's with the management and operations of primary healthcare facilities. The State Commissioner for Health oversees the functions of the SMOH. The Hospital Management Board (HMB) and the Local Government Authority (LGA) also play vital roles in healthcare service provision at the state level. The HMB ensures personnel administration supplies, financing, management and maintenance of equipment of state hospitals. It also ensures provision of drugs and administration of health centres and urban clinics. The HMB is headed by a chairman who reports to the state commissioner of health.

Lastly, the local governments are required to provide primary health facilities. Primary provision comprises the creation of community health centres, clinics and dispensaries, sanitation and hygiene services (FMOH, 2007). Provision of healthcare needs at the LGA is headed by the Health and Social Welfare Counsellor who also reports to the SMOH (ADB, 2002)

Activities in the FMOH and the SMOH are formerly linked through the National Council of Health (NCH). The NCH is chaired by the FMOH with members comprising all the state commissioners of health. The functions of the NCH includes holding quarterly meetings to analyse and seek measures that promote health conditions in the country (FMOH, 2007; ADB 2002)

2.4 Healthcare Financing in Nigeria

Healthcare in Nigeria is financed through public and private sources. Public provision of healthcare in Nigeria is funded by the federal, state and local government, while private provision includes funding by individuals in the household, firms and donors (Soyibo, 2005; Lawanson, 2014; Olawumi, 2015). There are also funding from health insurance scheme (NHIS), which generally covers individuals in the formal sector[9]. Employers of labour in the formal sector are required to register with the NHIS, and appoint an NHIS- registered health maintenance organisation (HMO)[10] of their choice. They are also expected to contribute 10% while workers contribute 5% of their basic income to the scheme (NHIS, 2015).

Healthcare benefit for an employee under the NHIS covers a spouse, and four biological children below 18 years of age. Persons above 18 years who are in tertiary institution are covered under the tertiary insurance scheme. Benefits in the scheme includes; outpatient care, maternity care for up to 4 live births, preventive care including immunisation, consultation with healthcare specialists, prescription drugs contained in the essential drugs[11] lists, diagnostic tests included in the essential diagnostic tests lists and hospital care in a standard ward for cumulative of 15 days per

[9] The formal sector social health insurance scheme covers individuals in the public sector, organised private sector, armed forces, police and allied services, students of tertiary institution and voluntary contributions.

[10] HMOs are created to check agency problems in healthcare. They check demand side problems by ensuring that insured individuals make some out-of-pocket payments for medical care and also check supply side problems by monitoring healthcare providers carefully, penalizing them for profligate prescription and giving them financial incentives to provide for essential care. Some HMOs are insurers and providers of healthcare.

[11] Essential medicines are defined as "those that satisfy the priority health care needs of the population," They are intended to be available within the context of a functioning healthcare system at all times, in adequate amounts, in appropriate dosage forms, with assured quality and at a price that individuals can afford. The WHO has a comprehensive list from which countries draw up subjective essential drugs and diagnostic tests. For Nigeria it includes drugs such as antimalarial, antiepileptic, local analgesics, antiretroviral, anti-tuberculosis and anti-migraine (FMOH, 2003; Manikandan, 2015)

year. For inpatient care, the primary care giver is responsible for per diem payments for the period (NHIS, 2015)

Despite intentions to reduce out-of-pocket payments for healthcare through the NHIS, the existing highly informal nature of the Nigerian economy excludes majority of the workforce from the scheme. The NBS (2010) showed that the formal sector in Nigeria employs only about 6.28% of the working population. This implies that if every individual in the formal sector is registered in the social health insurance programme, over 90% of the working population do not have access to the scheme. This connotes that payment for healthcare in Nigeria is mainly borne by out-of-pocket payments.

Table 2.1 provides insight to healthcare spending in Nigeria. The figures show that there had been considerable increase in public sector finance of healthcare. However, households still bear a larger share of payments for healthcare in the country.

An overall examination of Table 2.1 shows that there had been steady increase in total health expenditure (THE) in Nigeria from 1998 to 2013. As at 1998, a total of ₦157 million was recorded as THE in Nigeria. In 2005, the figure increased to ₦977 million and in 2013 it rose further to ₦1, 653 billion. The fraction of government expenditure in THE, equally experienced a rise over the same period. Although, government spending in THE increased between 1998 and 2013, it is still less than 30% of THE. This unveils relatively higher fraction of private spending on THE in Nigeria. Government expenditure in THE, rose from about 14.96% in 1998 to approximately 26.02% in 2005 and in 2013, it slightly increased to about 27.60%.

Sequel to the increase in government contribution to THE in Nigeria, private health expenditure in THE experienced some reduction but the figures still remain considerably high even in recent times. A close examination of the figures shows that

private health expenditure was about 85% of THE in 1998. As at 2005, it had declined to about 73.98%. In 2013, it further marginally declined to approximately 72.40%.

Table 2.1 Sources of Health expenditure in Nigeria.

Description	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total Health Expenditure (THE)																
₦ Million	157	179	215	256	279	662	788	977	687	930	972	1,041,358	1,189,466	1,384,164	1,378,499	1,653,473
US $ Million	1,874	1,948	2,134	2,294	2,207	4,936	5,958	7,478	5,354	7,863	8,201	6,994	7,914	8,996	8,752	10,511
General Government Expenditure (Govt)																
₦	23,502	29,882	40,391	69,765	60,211	123,681	208,207	254,174	225,987	305,832	357,642	325,945	310,450	430,475	457,661	456,359
Govt/THE(%)	14.96	16.61	18.77	27.22	21.6	18.69	26.4	26.02	32.9	32.9	36.8	31.3	26.1	31.1	33.2	27.6
Private Expenditure (PV)																
₦ Million	133,579	150,008	174,818	186,518	218,520	537,980	579,916	722,513	460,903	623,748	614,211	715,413	879,016	953,689.5	920,837	1,197,115
PV/THE(%)	85.04	83.39	81.23	72.78	78.4	81.31	73.58	73.98	67.1	67.1	63.2	68.7	73.9	68.9	66.8	72.4
Firms Expenditure																
₦ Million	4,308	6,314	10, 047	14,647	17, 817	20323	26,068	29,670	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Firms/TH (%)	2.74	3.51	4.67	5.72	6.39	3.09	3.31	3.04	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Households (HHD)																
₦ Million	109	119	130	158	184	490	518	657	451	612	639	685	853	938	903	1,159
HHD/THE(%)	69.21	66.03	60.35	61.50	65.87	74.02	65.73	67.22	65.60	65.80	60.70	65.80	71.70	67.70	65.50	70.10
Donors Expenditure																
₦ Million	20,551	24,912	34,899.	14,269	17,104	27,872	36,038	36,297	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Donors/THE(%)	13.08	13.85	16.22	5.57	6.14	4.21	4.57	3.72	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Health Insurance expenditure (HIE)																
₦ Million	2812	4281	7231	11456	13825	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
HIE/THE	1.79	2.38	3.36	4.47	4.96	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
All Private Expenditure aside Household (PEAHHD)																
₦ Million	24,866	31,229	44,936	28,909	34,925	48,235	62,025	66,024	10,303	12,085	24,296	30,199	26,168	16,609	17,920	38,029
PEAHHD/THE(%)	15.83	17.36	20.88	11.28	12.53	7.29	7.87	6.76	1.50	1.30	2.50	2.90	2.20	1.20	1.30	2.30
Gross Domestic Product (GDP)																
₦ Million	2,882,310	3,322,030	4,902,800	5,702,650	5,927,680	8,742,647	11,673,602	14,735,324	18,564,595	20,657,318	24,296,329	24,794,239	33,984,754	37,409,861	40,544,100	42,396,766
THE/GDP(%)	5.45	5.42	4.39	4.49	4.70	7.57	6.76	6.63	3.70	4.50	4.00	4.20	3.50	3.70	3.40	3.90

Note:

1. Figures from 1998 to 2005 are Authors computation from Soyibo (2005) and Soyibo *et al* (2009) in Lawanson (2014)
2. Figures from 2006 to 2013 are Authors computation from WDI various years, CBN statistical Bulletin 2012 and 2013.
3. Total private expenditure was derived as the difference between total health expenditure and total government expenditure

Sources: Soyibo (2005) and Soyibo *et al* (2009) in Lawanson (2014), WDI various years, CBN (2012); (2013)

It can also be observed from the table that though private health expenditure in THE declined in the period under review, household expenditure; also a sub-fraction of THE, did not fall over the period. For instance, in 1998, household expenditure was about 69.21% of THE. In 2005, it slightly declined to about 67.22% of THE and in 2013 it increased to approximately 70.10% of THE. Aside household payments, other forms of private health expenditure comprising contributions especially from firms and donors recorded a fall in value. In 1998, all forms of private expenditure aside household payments made up 15.83% of THE. The figure fell to about 6.76% of THE in 2005 and further declined to approximately 2.30% of THE in 2013.

It can be deduced that among all sources of healthcare finance in Nigeria, expenditure from private sources dominated THE. Private sources particularly with reference to household payments superseded all other sources of financial payments for healthcare in Nigeria. Household payments for healthcare accounted for the highest fraction of healthcare financing in Nigeria relative to other sources. This gives inkling to the nature of health finance in Nigeria such that the burden of healthcare payment rests heavily on the individuals and households through out-of-pocket payments.

The apparently huge out-of-pocket payments for healthcare can very well be related to exclusion of the informal sector in purchase of health insurance in the country. With significantly large fraction of the Nigerian populace in the informal sector, most individuals will have to purchase healthcare through out-of-pocket payment. The intended support of the NHIS reaches only an insignificant proportion of the population. As at 2014, only 3% of the Nigerian population had coverage from the scheme (Olawumi, 2015). This is quite distant from the intended 30% coverage of the Nigerian populace by 2015 (NHIS, 2015). Thus, majority of Nigerians currently engage in out-of-pocket health expenditure which is the most expensive and least inclusive health financing method. This form of health financing weighs heavily on household budgets and can increase poverty rates and inequality.

Figures from the table also show a decline in the fraction of Gross Domestic Product (GDP) attributed to health expenditure in Nigeria. Although it fluctuated from about 5.45% in 1998 to about 6.63% in 2005 and to approximately 3.90% in 2013, the general trend is an overall decline. This statistics is daunting with respect to the

increase in THE in Nigeria, and rising population figures in the country. With regards to the expenditure approach of computation of GDP, the figures underlie an apparent poor performing health sector in Nigeria relative to other sectors of the economy.

2.5 Health Profile of the Nigerian Population

The health profile in an economy generally depicts the prevailing health situation. Table 2.2 shows health status indicators in Nigeria and compares the figures to global average and the Millennium Development Goals (MDGs) 2015 target. The figures show that in Nigeria, indicators of health status such as life expectancy, infant and under child mortality as well as maternal mortality have shown some improvements from 1990 to 2012.

The figures show that life expectancy at birth as at 1990 was 47 years. In 2005 it improved to 49 years and further to 52 years in 2012. In the same vein, infant mortality per 1,000 live births reduced from 126 in 1990 to 97 in 2005. It further dropped to 78 in 2012. Similarly, under-five mortality per 1,000 live births was approximately 90 as at 1990. The figure declined to about 68 in 2005 and again to 48 in 2012. Likewise, maternal mortality per 100,000 live births declined from 1,200 in 1990 to about 740 in 2005. The figures dropped further to approximately 560 in 2012.

Although there have been improvements in health status indicators in Nigeria, comparison of health status in relation to global average figures shows that health conditions in Nigeria is still in poor state. For instance the world average figure of life expectancy was 62 years in 1990 and 70 years in 2012. Figures of life expectancy in Nigeria were apparently lower at 47 and 52 years in 1990 and 2012 respectively. This shows that estimates of life expectancy in Nigeria as at 2012 was still lower than world figure in 1990. Again, global average infant mortality figures per 100,000 live births was about 63 and declined to about 36 in 2012. Figures for Nigeria were 126 in 1990 and 78 in 2012. This again shows that infant mortality estimates in Nigeria more than doubled existing global figures. Global figures for under-five mortality per 1,000 live births were 90 in 1990 and 48 in 2012. Figures for Nigeria were 213 and 124 in 1990 and 2012 respectively. In Nigeria, under-five mortality also more than doubled world estimates. World estimates of maternal mortality was approximately 380 per 100,000 live births in 1990. In 2010 it dropped to about 230. Estimates for Nigeria were shown

to be 1,200 in 1990 and 610 in 2010. This shows that maternal mortality is also outstandingly high in Nigeria.

Table2.2 Indicators of Health Status: Estimates for Nigeria, Global Average and MDG and SDG Target

Description/Year	**1990**	**1995**	**2000**	**2005**	**2010**	**2012**	**Decline % (1990-2012)**	**MDG target**	**SDG target**
Life Expectancy at birth (years) Nigeria	47	47	47	49	52	52	n/a	n/a	n/a
Global average	62	64	65	65	68	70			
Infant Mortality(per 1,000 live births) Nigeria	126	124	113	97	82	78	38	Two third reductions (67%)	End preventable deaths of new born
Global average	63	60	51	44	38	36	43		
Under Five Mortality (per 1,000 live births)) Nigeria	213	209	188	159	131	124	42	Two third reductions (67%)	End preventable deaths of under-five aged children
Global average	90	85	75	68	52	48	47		
Maternal Mortality ratio (per 100,000 live births)) Nigeria	1,200	1100	950	740	610	560*	49	Three quarter reduction (75%)	Reduce global maternal mortality ratio to less than 70 per 1,000,000 live births
Global average	380	360	330	270	230	n/a	40		

Note:

1. Country estimates are from World Bank indicators
2. Global estimates are derived from UNICEF global data base 2014, UNDP 2007 and WHO 2014.
3. n/a signifies not available
4. Decline in maternal mortality was computed for the periods 1990 to 2010 due to inability to obtain global figures.
5. * Attached to maternal mortality figure for 2012 is an indication that it was not used in computation of decline in maternal mortality as shown in the table. This is to enable comparison of figures with global average. Global decline was computed from 1990-2010.

Sources: UNDP (2007); WHO (2014); UNICEF (2014); World Bank; (2014); UN (2015)

In an attempt to improve global health situation and developmental prospects, the World Bank instituted target estimates for health status indicators. These projections

are included in the MDGs. The targets include 67% reduction in infant and under-five mortality per 1000 live births and 75% decline in maternal mortality per 100,000 live births between 1990 and 2015. The MDG has been expanded into the SDGs at the end of 2015. The SDG targets are built on the goals of MDG to achieve sustainable development by 2030. Among the 17 goals of SDG, the third goal which relates to ensuring healthy lives and promotion of well-being for all ages intends to end preventable deaths for infants and under-five aged children. The targets also includes reduction in maternal mortality per 100,000 live births to less than 70 at the end of 2030 (UN, 2015).

Comparing the MDG targets with figures of health status for Nigeria and world estimates reveals that world figures were closer to MDG goals than Nigeria. Globally, infant and under-five mortality per 1,000 live births respectively fell by 43% and 47% between 1990 and 2012. Figures for Nigeria show that infant and under-five mortality per 1,000 live births dropped by about 38% and 42% respectively. To have attained the MDG target in 2015, estimates for infant and under-five mortality in Nigeria is required to fall respectively further by 29% and 25% within a space of three years. Global records for maternal mortality per 100,000 live births dropped by about 40% from 1990 to 2010. Figures for Nigeria showed a 40% decline over the same period. This shows higher reduction for maternal mortality in Nigeria relative to world decline, nonetheless, it remains high in Nigeria compared to world estimates. Achievement of the MDG target for maternal mortality in Nigeria would have necessitated 26% further reduction in maternal deaths from 2010 to 2015. The trend in health status indicators in Nigeria was a pointer to small probabilities of achieving the MDG targets in the country.

Global average figures for decline in infant mortality did not meet the MDG target. The figures are about 24% away from reaching the MDG. Revision of the target for infant mortality in the SDG requires reduction of infant mortality mainly through ensuring end of preventable deaths. Figures for infant mortality in Nigeria were about 29% away from the MDG and show less chances of achieving the SDG in relation to global figures. Similarly, global estimates of under-five mortality was about 20% from attaining the MDG target and that for Nigeria was approximately 25% from reaching MDG. This difference also shows less tendency of reaching the SDG goal of

eradicating morality of preventable deaths in Nigeria in relation to global chances. The figures show more chances of achieving the SDG for under-five than infant mortality due to closer averages of the latter to the MDG.

Examination of maternal mortality in Nigeria in relation to the SDG shows slim chances of achieving the goal. Maternal mortality recorded lowest figures of about 560 per 100,000 live births in 2012. Meeting the SDG goal for maternal mortality in Nigeria implies reduction of maternal mortality by above 490 per 100,000 live births in 2030.

2.6 Illness Prevalence in Nigeria

There are obvious interrelationships between health status and illnesses prevalence. This is because illnesses for instance influence mortality figures which in turn determine life expectancy. The WHO identifies a total of 159 illness types that exists in the global economy (WHO, 2004). These illnesses are grouped into communicable diseases, non-communicable illness and injuries. Among the group of illnesses listed by the WHO, the Centre for disease control (CDC, 2013), identifies ailments that are major determinants of the prevailing health status in Nigeria. This is with reference to mortality figures in the country. Table 2.3 presents these illnesses and the associated mortality figures in Nigeria.

Table 2.3 Leading Causes of Death in Nigeria

Type of Illness	Mortality (%)	Illness Group
Malaria	20	Communicable (Infectious and parasitic)
Lower Respiratory	19	Communicable (Respiratory infection)
HIV/AIDS	9	Communicable (Infectious and parasitic)
Diarrhoea	5	Communicable (Infectious and parasitic)
Road Injuries	5	Injuries (Unintentional injuries)
Protein Energy Malnutrition	4	Communicable (Nutritional deficiencies)
Cancer	3	Non-communicable(Malignant neoplasms)
Meningitis	3	Communicable (Infectious and parasitic)
Stroke	3	Non-communicable(Neuropsychiatric conditions)
Tuberculosis	2	Communicable(Infectious and parasitic)
Others	27	Communicable, non-communicable, injuries

Note: 1. Illness groups where determined using WHO classification of diseases
2. Illness type in bracket show sub groupings of the respective illness in line with WHO classification
Sources: Centre for Disease Control (2013), World Health Organisation (WHO, 2004)

Table 2.3 shows a total of ten illnesses as leading causes of mortality in Nigeria. Specific illness conditions identified reveal that seven of these illnesses are communicable diseases. These are malaria, lower respiratory infections, HIV/AIDS, diarrhoea, protein energy malnutrition, meningitis and tuberculosis. Among non-communicable diseases, cancer and stroke are identified as the leading cause of mortality in Nigeria. In the group of injuries; road injuries are known to add significantly to mortality figures in the country.

The figures in Table 2.3 further show that overall; mortality in Nigeria is largely due to being ill with malaria. Mortality estimates from malaria show that the illness contributes about 20% to total mortality figures in the country. This is closely followed by lower respiratory infections (19%), HIV/AIDS (9%), diarrhoea (5%) and road Injuries (5%). Others include protein energy malnutrition (4%), cancer (3%), meningitis (3%), stroke (3%) and tuberculosis (2%). The remainder of all other illness conditions constitute 27% of total mortality figures in the country.

It can be observed from Table 2.3 that mortality in Nigeria is basically in connection with communicable diseases relative to other illness types. Close examination of the figures in Table 2.3 show that health status in Nigeria is majorly determined by illnesses in the group of communicable diseases with malaria accounting for most parts of health conditions in the country. This is again shown by an examination of specific contributions of malaria to health status indicators in Nigeria. In terms of definite contributions of malaria to health status measures in Nigeria, it is shown that the illness singly accounted for a total number of about 11,000 maternal deaths per 100,000 live births, 250 infant mortality per 1,000 live births and 390 under-five mortality per 1,000 live births (CSLAC, 2012). Malaria contribution to mortality figures has unequivocal implication on life expectancy in the country (LHO, 2012). This is because it influences the number of years that a new born is expected to live.

Table 2.4 shows reported cases of illness and deaths in Nigeria. The statistics reiterates the high prevalence and mortality associated with malaria in Nigeria. For instance in 2011, there were over six million reported cases of illness and over 80% of the reported cases were due to malaria. Other ailments reported which are also highly prevalent in the Nigerian economy include: diarrhoea (non-bloody) (7%), measles (0.9%), pneumonia (3%), HIV/AIDS (0.7%) and tuberculosis (0.4%).

Table 2.4 Reported Cases of /Deaths from Notifiable Diseases in Nigeria (Selected Ailments 2007-2011)

Description/Year	2007	2008	2010	2011
Total Reported Cases of Illness (TRC)	6,882,246	7,574,667	5,004,604	6,109,945
Total Reported Deaths (TRD)	17,116	5, 749	6,853	5,924
TRD/TRC (%)	0.002	0.001	0.001	0.001
Type of ailment				
Diarrhoeal (non-bloody)	1,069,133	893,482	569,052	431,852
Reported cases/ TRP (%)	15	12	11	7
Reported deaths/TRD (%)	6	n/a	13	10
Diarrhoeal (bloody)	424,668	395,443	209,039	194,714
Reported cases/ TRP (%)	6	5	4	3
Reported deaths/TRD (%	15	n/a	4	3
Measles	12,049	65,804	26,290	53,522
Reported cases/ TRP (%)	0.2	0.9	0.5	0.9
Reported deaths/TRD (%	1	29	3	6
Malaria	4,456,976	5,307,553	3,837,215	5,085,53
Reported cases/ TRP (%)	65	70	76	83
Reported deaths/TRD (%	61	n/a	38	54
Pneumonia	374,191	364,331	198,409	153,759
Reported Cases/ TRP (%)	5	5	4	3
Reported Deaths/TRD (%	7	24	12	7
Tuberculosis	31,264	32,882	29,949	24,752
Reported Cases/ TRP (%)	0.5	0.4	0.6	0.4
Reported Deaths/TRD (%	1	27	8	2
HIV/AIDS	44,010	47,365	44,290	41,961
Reported Cases/ TRP (%)	0.6	0.6	0.9	0.7
Reported Deaths/TRD (%	4	16	9	8

Notes:

1. TRP and TRD respectively implies total reported cases of illness and total reported deaths
2. n/a means not available

Source: National Bureau of Statistics (NBS) 2012.

Aside the high prevalence of malaria in Nigeria, the statistics show that there has been steady increase in the share of malaria in total reported cases of illness. For instance, figures of illness prevalence in Nigeria showed that in 2007, malaria constituted as high as 65% of total reported illnesses. This rose to about 70% in 2008 and further to approximately 83% in 2011. Mortality from malaria remained high but fluctuated over the period. For instance, in 2007 malaria contributed about 61% of total reported deaths. This figure declined to about 38% in 2010 but rose to approximately 54% in 2011.The figures further illustrate that malaria prevalence remains high in Nigeria even in recent times. Overall, the statistics in Table 2.4 affirm high incidence of communicable diseases in the Nigerian economy.

2.7 Policy Actions to Curb Malaria Prevalence in Nigeria

Attempts to curb malaria prevalence in Nigeria date as far back as 1955 when the World Health Organisation (WHO) introduced the malaria eradication programme (MEP) between 1955 and 1969. Nigeria was included among the countries in this first large-scale multilateral initiative for malaria control. The MEP was set up to achieve complete eradication of malaria in the globe with the use of massive indoor residual spraying of Dichloro-diphenyl- Trichloroethane (DDT). The goal of the MEP was achieved only for some regions of the world particularly in Southern Europe, the former USSR and some countries in North Africa and the Middle East (Allilio *et al* 2004; MIS, 2010).

With the failure of the MEP design in Nigeria, the country introduced a second plan by the year 2,000 to reduce continual scourge of the illness. This plan was a joint effort with a league of other African countries to reduce the burden of malaria by half in the year 2010. The strategy considered for achievement of this goal includes:

- Prompt diagnosis and treatment of malaria using effective medicine;
- Distribution of insecticide treated nets (ITN);
- Indoor residual spraying (IRS); and
- Prevention of malaria in pregnancy with the use of intermittent preventive treatment

Implementation of the policy action to lessen malaria burden in Nigeria focused mainly on the most vulnerable population groups to malaria attack. This action plan covered two periods; from 2001 to 2005 and 2006 to 2010. The plan for 2006 to 2010

was revised in 2008 in response to the new global direction for malaria control efforts which required focus for malaria control efforts not only on the vulnerable groups but also on all population groups at risk of malaria. The action plan for malaria control in Nigeria was thus revised to cover 2009 to 2013. This policy action was referred to as the National Strategic Plan for Malaria Control (NSPMC). It was developed by the National Malaria Control Programme (NMCP), the Roll Back Malaria (RBM) partners, state and local governments' health authorities and other stakeholders. The NSPMC was integrated into the National health strategic plan of the FMOH. The general objective of this strategic action was to minimise the socioeconomic impact of malaria in Nigeria. Specific targets of the NMCP which were to be achieved as at 2013 include;

- Reduction in total mortality and morbidity from malaria by 50%;
- Reduction in malaria prevalence in children under age 5 by 50%;
- Increase in net ownership by at least 80% in Nigerian households;
- Introduction and scale up of indoor residual spraying (IRS) to national coverage of 8% in selected areas by 2010 and 20% by 2013;
- Increase in diagnostic malaria testing in 2013 by at least 80% for individuals aged 5 years and above who seek for health treatment due to malaria from health care facilities; and
- Increase in the percentage of pregnant women who receive drug for prevention of malaria in pregnancy to about 100%. This goal was intended only for women who attend antenatal care.

The malaria indicator survey (MIS) 2010, evaluated the achievement of the NSPMC and showed increase in ownership of mosquito nets by about 42% in Nigeria as at 2010. This was attributed to the mass distribution of long lasting insecticidal treated nets (LLIN) by the Global fund, World Bank, Department for International Development (DFID), millennium development funds and the national malaria control programme in Nigeria. Regardless of the increase in the ownership of LLIN in Nigeria, there was higher percentage of children with malaria attack in 2010 (35%) compared to 2008 (16%). This can probably be attributed to less use of the LLIN relative to ownership. Only about 24% of households slept under the insecticidal treated net. The MIS (2010) further showed that less than 1% of households in Nigeria had received

IRS and only 13% of women received the intermittent preventive treatment from malaria during pregnancy (IPTMp). This was higher than the figure of 8% in 2008 (NPC, NMPC and ICF 2012). Overall, the MIS, 2010, showed slight improvements in achievement of the targets of the NSPMC particularly in relation to ownership of bed nets and women who received IPTMp.

2.8 Labour Force Participation in Nigeria

Labour force participation in Nigeria has declined over the years. Figures from the National Bureau of Statistics (NBS) (2012) show that in 2007, unemployment rate in Nigeria stood at about 12.7%. The rate of unemployment in the country rose to approximately 14.9% in 2008 and further to about 19.7% in 2009. Unemployment rate in Nigeria had further increased to about 21.4% and 23.9% in 2010 and 2011 respectively. Aside rising unemployment rates in Nigeria, there are indications that those who are employed are commonly engaged in informal sector employment, particularly self- employment type. This further worsens prospects for increased labour earnings given that the informal sector has less chance for economic advancement relative to the formal sector. This particularly is in terms of access to borrowed funds for increased scale of operation. The distribution of occupational types in Nigeria is shown in Table 2.5.

Table 2.5 Distribution of the Economically Active Population in the Nigerian Labour Force by Occupational Types and Place of Residence (%)

Level/ Employment Type	Informal Self-employment		Informal (self-employment) Total	Formal/Informal Employment	Total
	Self - employment in Agriculture	Other self – employment (Owned account)		Wage Employment	
National	44.31	48.66	92.97	7.03	100
Urban	20.68	66.19	86.87	13.13	100
Rural	51.74	43.14	94.88	5.12	100

Source: Computed from HNLSS Data in NBS (2010).

The figures lend credence to the highly informal nature of the Nigerian workforce. Most individuals are shown to be more engaged in informal sector self-employment activity than wage work in Nigeria. For instance, figures at the national level show that there are about 44.31% of the workforce in agricultural self-employment and 48.66% in non-agricultural self-employment. Summation of agricultural and non-agricultural self-employment types indicates that approximately 93% of the Nigerian workforce[12] is engaged in self-employment activity[13]. Persons in wage employment type make up a paltry 7.03% of the workforce.

An examination of employment distribution across the urban and rural areas shows that there are some differences in occupational distribution. Although informal sector employment is common in both the urban and rural areas, employed persons in the urban areas have higher proportion of wage workers than in the rural areas. Individuals in the urban areas engaged in wage work are about 13.13% of the urban workforce while wage workers in the rural areas are 5.12% of the rural labour force. The statistics further indicate that more persons in the rural areas are in self- employment work type than those in the urban areas. About 86.87% of the urban working populace are in self-employment type while approximately 94.88% of the rural workforce is engaged in self-employment activity.

Further analysis of self-employment distribution reveals that persons in the rural areas are generally employed in agricultural self-employment than those in the urban areas. They are also less engaged in owned account work relative to urban residents. About

[12] Workforce in this case refers to individuals in the economically active population who are gainfully employed.

[13] Labour force participation is examined across self and wage employment types to show employment distribution in relation to informal sector prospects for economic expansion. Persons in informal wage employment generally do not own personal businesses and hence may not pursue business expansion. To reduce overlap of being engaged in self and informal wage employment, the figures are computed using main employment types as shown in the HNLSS (2010).

51.74% of employed persons in the rural areas are found in agricultural self-employment activity. This significantly contrasts with about 20.68% of the urban workforce employed in agricultural self-employment work. Also, approximately 66.19% of the urban work force is in non-agricultural self-employment. Persons employed in non-agricultural self-employment in the rural workforce were about 43.14%. These figures further reiterate high chances of poverty incidence in the rural than urban areas given the existing subsistence agricultural practise in the country.

2.9 Gender Distribution of the Employed Populace in Nigeria

There are also disparities in employment distribution of persons in Nigeria across gender. Males are commonly expected to participate more in the labour force, particularly due to societal demand on males' for financial provision and less demand for males' time in home upkeep and child nurture. Child care provision and domestic activities are ideally the responsibility of females. Despite requirement for female engagement in home upkeep and child rearing, a significant proportion of females in the economically active population in Nigeria are employed. This is particularly for informal self-employment. The existing high poverty incidence in the country possibly spurs female engagement in economic activities. Table 2.6 presents figures for gender distribution of the Nigerian workforce.

Table 2.6 Gender Distribution of Employed Persons in Nigeria

Level/Employment	Informal Self-employment				Total Self-employment		Formal/Informal	
	Self-Agricultural employment		Non agriculture self-employment(Owned account)				Wage Employment	
	Male	Female	Male	Female	Male	Female	Male	Female
National	63.22	36.78	39.88	60.12	50.67	49.33	62.52	37.48
Urban	61.72	38.28	45.61	54.39	53.63	46.34	62.65	37.35
Rural	63.41	36.59	37.12	62.88	50.27	49.74	62.41	37.59

Source: Authors' Compilation from HNLSS Draft Report in NBS (2010).

At the national level, it is shown that there are more males than females in agricultural self- employment and wage employment. However, female participation in non-agricultural self-employment is higher than that of males. For instance, agricultural self-employment is shown to have about 63.22% males and 36.78% females. Wage employment on the other hand has approximately 62.52% males and 37.48% females. However, non-agricultural self-employment comprises about 60.12% females and 39.88% males. Although male participation is higher for self-agricultural and wage employment, analysis of the summation of self-employment types shows that male participation in self-employment is approximately equal to that of females. The figures at the national level indicate that approximately 51% males and 49% females are in self-employment activity. This indicates that differences in male and female participation in the Nigerian labour force can be observed only for wage employment. The higher percentage of male engagement in wage employment relative to females has unfavourable implication on female earnings in Nigeria. This follows from the low prospects for economic advancement and welfare that characterise informal sector employment activity.

Gender distribution of employment along urban and rural dichotomy follows similar trend as that of national level estimates. Thus national level estimates for gender differences in employment are reflected in the urban and rural areas. It can therefore be inferred that male welfare in terms of income prospects is higher than that of females regardless of place of residence.

2.10 Overview of Labour Participation across the Globe

The level of labour participation in an economy influences the rate of economic advancement. Unemployment particularly hampers economic progress. The international labour organisation (ILO) identifies some of the damaging effects of

unemployment on labour participation as unemployment costs. These costs have been grouped as personal and social.

Personal costs relate the resultant effect of unemployment with loss in individual satisfaction and sometimes associate it with societal stigmatisation. Social costs on the other hand project the effect of unemployment in terms of reduced economic output and production below an economy's potential or capacity.

Other social costs as a result of unemployment relate to the reduced prospects of generating government revenue through income taxes. This is particularly for formal sector employment. This can result to increased government debt to cater for the needs of the unemployed or a cut down in some government expenditures. This subsequently implies reduced supply of infrastructural facilities that will promote industrialisation and increase labour employment.

Apparently, the low welfare that often characterise high unemployment rate points to existence of poor health situation for such group of persons. This is because individuals in the working population who are willing and able to work but do not get jobs will show poorer healthy status on the average than employed persons (ILO, 2014). This follows from the lack of fulfilment, satisfaction and low income that characterise the unemployed individual.

Figures for unemployment rates hence depict the underlining hazardous consequence of non-participation of labour in economic activities. Table 2.7 shows the unemployment situation in the global economy with regional figures for SSA and selected countries in SSA.

The table illustrates that unemployment statistics has been on the increase across the globe. Worldwide unemployment rate is shown to have increased from about 5.5% in 2007 to approximately 6% in 2013. This suggests that globally, there has been a rise in the detrimental effects of low labour participation in economic activities.

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Table 2.7 Percentage of Unemployed Persons: Global Estimates, SSA Region and Selected Countries in SSA

Region Country/Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
World	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5.5	5.6	6.2	6.1	6.0	6.0	6.0
SSA	n/a	n/a	n/a	n/a	n/a	n/a	n/a	7.5	7.7	7.7	7.6	7.6	7.6	7.6
SSA (North)														
Algeria	29.8	27.3	25.9	23.7	20.1	15.3	12.3	13.8	11.3	10.2	10.0	10.0	11	9.8
Mali	7.6	7.7	7.7	7.7	7.8	8.5	8.3	8.5	8.4	8.5	8.1	8.1	8.1	8.2
SSA (East)														
Kenya	9.8	9.7	9.7	9.6	9.6	9.5	9.5	9.5	9.4	9.4	9.3	9.3	9.2	9.2
Tanzania	5.1	5.1	3.6	3.4	2.9	2.5	4.3	2.0	2.5	2.5	3.0	3.5	3.5	3.5
SSA(South)														
Zambia	12.9	15.1	14.5	15.3	15.5	15.9	15.7	15.7	15.7	15.6	13.2	13.2	13.1	13.3
Zimbabwe	6.3	5.1	4.8	4.5	4.2	4.6	5.1	5.1	5.7	6.4	5.5	5.4	5.3	5.4
SSA(West)														
Nigeria	7.6	7.6	7.7	7.6	7.7	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.5	7.5
Ghana	10.4	10.0	9.8	8.4	6.6	3.8	3.6	3.7	4.0	4.1	4.2	4.2	4.2	4.6

Notes:

1. World average figures and regional figures for SSA are from ILO 2014
2. Country figures are from WDI several years.
3. Countries were randomly selected
4. n/a means not available

Sources: Authors' compilation from ILO (2014) and WDI (various years)

Comparison of global figures for unemployment with that of SSA shows that though unemployment rate has increased across the globe, the statistics for SSA is higher than global average figures. Between 2007 and 2009 unemployment rate in SSA rose from 7.5% to 7.7% respectively. Thereafter it declined marginally to about 7.6% and remained steady till 2013. This contrasts with the 5% and 6% figures for global unemployment rate between 2007 and 2013. The relatively higher unemployment in SSA shows that unemployment costs are higher in the region compared to what is obtained across the globe.

Further examination of unemployment rates across country specific lines in SSA indicates differences in country unemployment figures. For instance, between 2000 and 2013 unemployment statistics for selected SSA countries was shown to be relatively higher in North SSA (Algeria: 29.8-9.8%; Mali: 7.6-8.2%), East SSA (Kenya: 9.8-9.2%), South SSA (Zambia: 12.9-13.3%) and in West SSA (Nigeria: 7.6-7.5%) than other countries in SSA. Between 2000 and 2013, unemployment rates were shown to be lower in SSA countries such as East SSA (Tanzania 5.1-3.5%), South SSA (Zimbabwe: 6.3-5.4%) and West SSA (Ghana: 10.4-4.6%).

It is noteworthy that the figures for unemployment in SSA are in close approximation to unemployment statistics for the Nigerian economy. Unemployment statistics for SSA in 2007 was estimated at 7.5%. Figure of unemployment rate for Nigeria in the same year was 7.6%. Unemployment rate in SSA was further shown to be 7.6% in 2010 and 2013. Statistics for unemployment in Nigeria was shown to be 7.6% and 7.5% for the same period. These figures indicate that unemployment representation in Nigeria appropriately captures the image of the unemployment situation in SSA. This can largely be due to the high population composition of the Nigerian economy in Africa. Hence, the Nigerian economy can be used to capture average unemployment figures in SSA and the underlying detrimental effects of unemployment in economic advancement of SSA countries.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

This section presents the theories that explain employment decisions, methodological approaches and empirical findings of health on employment decisions. The section also provides a framework for illness costs, approaches and findings on costs associated with illness.

3.2 Review of Theoretical Literature on Health and Labour Market Outcome

Theories used in examining labour supply are generally applied in explaining employment decisions of individuals (Casale, 2003; and Stoep, 2008). This generalisation is based on the notion that labour supply decisions are basically dichotomous in nature. Individuals decide whether to be employed in the labour force and the number of hours to supply or not to participate at all and supply no work hours or workdays. There are basically two theories of labour supply in economic literature. They are the traditional neoclassical theory of individual labour supply and the household production theory (Stoep, 2008). Household production theory is further subdivided into the Becker (1965) theory of time allocation and the Granau (1977) theory of time use in the household. The underpinning assumptions and framework of these theories are examined below.

3.2.1 The Traditional Neoclassical Theory of Labour Supply

The traditional neoclassical theory of labour supply originated from the works of Hicks (1946). The basic assumption of the model is that an individual makes rational decision between leisure and work hours that maximises his/her utility and this decision is in no way affected by the decision of other individuals. There is hence a trade-off between leisure and work hours, implying that if the individual intends to work more hours he/she has to forgo some of the leisure time. The theory assumes that optimal allocation of work hours and leisure time are basically determined by the

prevailing market wage rate and non-labour income (reservation wage). An increase in the market wage rate is associated with two basic effects; the income and substitution effects. If income is held constant, an increase in wage rate raises the opportunity cost of leisure so that individuals will prefer to substitute more work hours for leisure. Hence, labour supply increases. This is called the substitution effect. On the other hand, increase in wage rate also increases an individual's income and thus affords the individual the luxury of purchase of more leisure time. This reduces work hours supplied and is called the income effect (Stoep, 2008). Given that both effects stem from a rise in wage rate, the final outcome of the effect of an increase in wage rate on work hours depends on which effect dominates the other. Where the substitution effect dominates the income effect, the individual increases work time relative to leisure time. Similarly, dominance of income effect over the substitution effect reduces work time and raises leisure hours. Hence, the traditional neoclassical theory of labour suggests that labour supply is not necessarily a monotonic function of wages. The supply of labour hours for market work increases at a low wage rate and subsequently diminishes when wage is sufficiently high. The income and substitution effects are further enunciated in figure 3.1.

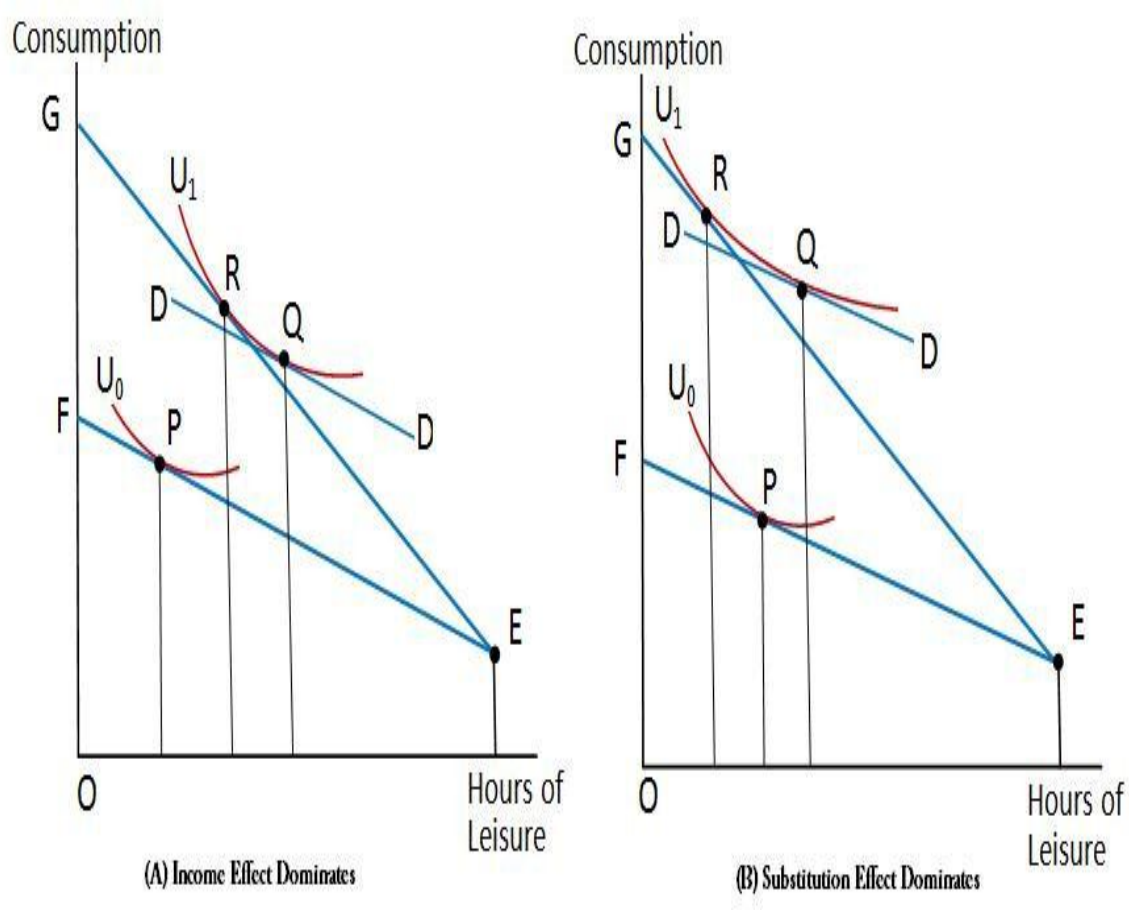

Figure 3.1: Impact of Wage Change (Income and Substitution Effects) on Labour Supply.
Source: Durnel (2010)

In figure 3.1, assuming an initial wage rate EF with utility maximised at point P, an increase in wage rate will rotate the budget line from EF to EG and make it become steeper with a new maximum utility at point R. The movement from P to R occurs in two steps. The first step shows the income effect where the increase in labour income shifts the budget line EF to a new budget line DD. The income effect can be analysed at point Q where the new budget line DD is tangential to the individual indifference curve U_1, keeping wage constant. It is examined by the movement from OP to OR. The substitution effect is also analysed keeping income constant; this is shown by the movement from Q to R along the indifference curve U_1. Dominance of the income effect over the individual's preferences implies that an increase in wage rate motivates individuals' demand for more leisure implying a decrease in work hours. This is shown in Figure 3.1A with an increase in leisure time from OP to OR (large income effect) and small movement from Q to R (small substitution effect). On the other hand, dominance of the substitution effect over individual's preferences implies increase in work hours and subsequent reduction in leisure hours. This is observed in Figure 3.1B with decrees in leisure time from OP to OR (small income effect) and larger movement from Q-R (large substitution effect) (Borjas, 2008).

The traditional neoclassical theory provides clear explanation of work hours based on the labour leisure trade off. It can also be used to determine whether an individual chooses to participate in the labour force or not (that is supply more than zero work hours or supply zero work hours) (Stoep, 2008).

One of the major criticisms of the traditional neoclassical theory of labour supply is that it does not recognise other ways by which an individual spends his/her time aside leisure and work time. Individuals can choose to spend their time in non-market activities such as home consumption and production of goods and services (Stoep, 2008). Non-market time involves household consumption such as; eating, sleeping, entertainment, cleaning, cooking and investing in health. Hence, the model does not add household production to labour supply decisions (Huffman, 2010). Huffman (2010) had earlier shown the framework that corrects for this weakness of the neoclassical model of labour supply with the inclusion of household production into the utility function of the individual. Assuming an individual in the household consumes and obtains utility from leisure (L) and two purchased goods; X_1 (food) and

X_2 (non-food goods and services), the utility function; assumed to be strictly concave is:

$$U = U(L, X_1, X_2; \tau) \quad (3.1)$$

Where τ is a taste parameter that influences the transformation of leisure and purchased goods into utility.

Assume that the individual receives time endowment for a given period which could be a year or a day and this time is allocated between leisure (L) and market work hours, h.

$$T = L + h \quad (3.2)$$

Hence, market work hours becomes

$$h = T - L \quad (3.2a)$$

Where the individual earns wage income (W) per hour (h) and also receives income (V), which comprises interest payments on assets, dividends on portfolio investment and unanticipated gifts and total income earned by the individual (IC) is allocated to purchasing X_1 and X_2, then, IC is such that:

$$IC = W \cdot h + V = P_1X_1 + P_2X_2 \quad (3.3)$$

Where P_1 and P_2 are the prices of goods X_1 and X_2. Substituting for market time or wage work hours (3.2a) into equation 3.3 yields the full income constraint (F) similar to Becker's (1965)[1] full income constraint;

$$F = W(T-L) + V = P_1X_1 + P_2X_2 \quad (3.4)$$

$$F = W\,T - W\,L + V = P_1X_1 + P_2X_2 \quad (3.4a)$$

Rearranging equation 3.4a yields

$$F = W\,T + V = W\,L + P_1X_1 + P_2X_2. \quad (3.4b)$$

The expression in equation 3.4b shows that full income received is spent on leisure, purchases of food and non-food goods and services.

The individual chooses L, X_1 and X_2 that maximize equation (3.1) subject to equation (3.4b). With the lagariange multiplier λ, the first-order conditions for the individual's decision problem are:

$$L: UL = \lambda W \quad (3.5a)$$

$$X_i: X_i\, U = \lambda P_i,\ i = 1, 2 \quad (3.5b)$$

$$\lambda: W \cdot T + V - W \cdot L - P_1X_1 + P_2X_2 = 0 \quad (3.5c)$$

Equations (3.5a) to (3.5c) can be solved jointly to obtain the general form of the individual's demand functions for leisure, food, as well as non-food goods and services:

(3.5a) $L^* = DL\ (W, P_1, P_2, V, \tau)$

(3.5b-3.5c) $X^*_i = X_i\ D\ (W, P_1, P_2, V, \tau)\ i = 1, 2.4$

The demands for leisure, food and non-food purchases as shown, are determined by the opportunity cost of time or the price of leisure which is the wage rate (W), the price of food purchases (P_1), the price of non-food purchases (P_2), income from assets and gifts (V) and tastes (τ).

Given the optimal choice of leisure and the time constraint (3.2), the general form of the labour supply equation can be obtained as:

$$h^* = T - L^* = Sh\ (W, P_1, P_2, V, \tau) \quad (3.6)$$

Hence, hours of work or labour supply is determined by exactly the same set of variables as those that determine the demand for leisure and non-market time spent in food, and non-food purchases. This indicates that leisure may not be the sole alternative to labour time in market activities (Huffman, 2010).

Another weakness of the traditional neoclassical theory is that, it ignores the influence of other household members such as the presence of young children; on labour supply decisions of individuals in the household. Other factors that influence labour supply such as age, education, gender and marital status are also not considered in the model. Most studies examining the labour supply decision of individuals show that these

variables have significant effects on work time. (Stern, 1989; Bridges and Lawson, 2008; Machio, 2012; Contreras *et al* 2010; Fadayomi and Ogunrinola, 2013).

3.2.2 The Household Production Theory

Unlike the neoclassical theory the household production theory adds the production function of the household to the theory of household decision-making. It brings the theory of the firm to the fore of household decision with the inclusion of the demand for food and supply of labour (Huffman, 2010). There are two versions of the household production theory; the Becker (1965) and Gronau (1977) theories of household time allocation. Becker's (1965) theory of time use assumes that the household produces the items in the consumption basket. Gronau (1977) on the other hand assumes that the household produces one good and purchases the other from the market. Both goods considered in Gronau (1977) are assumed to be perfect substitutes but Becker's assumption did not indicate whether the goods are substitutes or complements. The goods are however not jointly produced and do not have the same marginal cost of production. Again, unlike Gronau's supposition, Becker's specification does not consider leisure as an alternative to time use. Each of these versions of theories of household production is examined below.

3.2.2.1 Becker (1965) Model of Time Allocation

Becker's (1965) model of household production shows that the household consumes only those goods it produces. The production of any commodity consumed by the household requires inputs such as human time of one or more household members' and input purchased from the market. For simplicity, assume the household produces and consumes two goods; Z_1 (home prepared meals) and Z_2 (Non-food items such as washing and ironing). The household utility function assumed to be strictly concave is hence given as:

$$\boldsymbol{U = U(Z_1, Z_2, \tau)} \tag{3.7}$$

Where τ, is considered as a taste parameter. The household produces Z_1using time (t_1) of one or more household members and input bought from the market X_1 such as grocery. Similarly, Z_2 is produced using time of one or more household members' (t_2) and input X_2 such as soap, water or electricity for ironing. The production function for

Z_1 and Z_2 is assumed to be strictly concave[14] and exhibits constant returns to scale in the two variable inputs[15]. It is further assumed that there are no fixed costs of production or joint production[16] between the goods. The production function for the goods is expressed as;

$$\boldsymbol{Z_i = G_i(X_i, t_i, Q_i,)}\ \text{i= 1.2} \tag{3.8}$$

Where: Xi is the input used in producing Zi and Qi is a technology or efficiency parameter in the production of Zi. Assume that the household has a time constraint based on its time endowment for each time period say for a month, week or year and the household allocates this time between the two goods produced at home ($t_1 + t_2$) and hours of work for pay (h). Then, total time T is expressed as:

$$\boldsymbol{T = t_1 + t_2 + h}. \tag{3.9}$$

From equation (3.9) work hours for pay equals

$$\boldsymbol{h = T - t_1 - t_2} \tag{3.9a}$$

If the household receives income from members working for a wage rate W, and also receives unanticipated gifts or/and income from financial assists V, it is assumed that the sum of total income received by the household is I. Where the household income is expended on inputs used in producing Z which are X_1 and X_2 at prices P_1 and P_2, the budget constraint becomes:

$$\boldsymbol{I = Wh + V = P1X1 + P2X2} \tag{3.10}$$

Substituting for h (equation 3.9a) in the income constraint (3.10) gives the full wealth constraint as:

[14] A twice differentiable function f(x) is strictly concave if and only if its second derivative is negative. If points x and y are two points of a straight line joining two ends of the curve, then any point z on the curve must lie above the straight line. The optimisation process of concave production functions pursues a maximisation of production inputs.

[15] A function exhibiting constant returns to scale implies increase in output by equal amount of a rise in the quantity of input.

[16] Jointly produced goods refer to commodities generated simultaneously by a single manufacturing process using common inputs and being substantially equal in value. Costs incurred are separately unidentifiable until they reach the split off point. Examples are gasoline and kerosene from crude oil, butter and cream from milk. If the goods considered in Becker (1965) are jointly produced, it will be impossible to separate time spent for producing each good.

$$F = W.T + V = P_1X_1 + P_2X_2 + Wt_1 + Wt_2 \quad (3.11)$$

The household maximises the utility function (Equation 3.7) subject to the production technology (3.8), time constraint (3.9) and full wealth constraint (3.11)

The optimisation with Lagrange multiplier γ (Marginal utility of full income) becomes:

$$\prod = U(G_1(X_1, t_i, Q_I,)(\ G_2(X_2, t_2, Q_2,);\ \tau) + \quad \gamma(W.T + V - P_1X_1 + P_2X_2 + Wt_1 + Wt_2) \quad (3.12)$$

The first order condition for an interior solution is:

$$X_i: U_z; G_iX_i - \gamma P_i = 0, i = 1, 2 \quad (3.13)$$

$$t_i: U_{zi}; G_it_i - \gamma W = 0, i = 1, 2 \quad (3.14)$$

$$\gamma: WT + V - WL - P_1X_1 - P_2X_2 = 0 \quad (3.15)$$

Where Uz is the marginal utility (MU) of commodities Z_i, G_iX_i is the marginal product of input X_i in producing Z_i and G_it_i is the marginal product of input t_i in producing Z_i. The first order condition in equations 3.13 and 3.14 shows that households maximize utility subject to its production technology and resource constraints by ensuring that Z_1 and Z_2 are produced at minimum cost.

Solving for the general form of the implicit demand function for inputs in the model from equations 3.13 to 3.15, gives:

$$X_i^* = D_{xi}(P_1, P_2, W, V, Q_1Q_2, \tau) \text{ i=1, 2} \quad (3.16)$$

$$t_i^* = D_{ti}(P_1, P_2, W, V, Q_1Q_2, \tau) \text{ i=1, 2}$$
(3.17)

Hence, the general form of the demand equations for housework and supply of labour can be derived respectively as follows:

$$t_i^* = t_1^* + t_2^* = D_{ip}(P_1, P_2, W, V, Q_1Q_2, \tau) \quad (3.18)$$

$$h_i^* = T - t_1^* - t_{2=}^* S_H(P_1, P_2, W, V, Q_1Q_2, \tau) \quad (3.19)$$

The P's represent the purchase price of inputs for home production such as meat, fish, bread and eggs while W, represent labour wage, V is non-labour income, $\boldsymbol{Q_1}$ and $\boldsymbol{Q_2}$ represents technology or the efficiency parameter basically proxied by education given that education or skill will raise the productivity of household production time.

Becker's theory of household production is criticised mainly because of the assumption of constant returns to scale and that of no joint production[17] of Z_1 and Z_2 (Huffman, 2010). The house owner may dislike house cleaning, laundry or ironing and may choose not to produce this good or hire labour for such production. The house owner may also choose to produce both goods. In the latter case, the direct effect of home cleaning on utility will be negative which implies that less time will be spent on cleaning the home. On the other hand, where the house owner enjoys cooking, the direct effect of time spent cooking on utility will be positive and more time will be allocated to house work such as food production. Where the house owner decides to hire out house cleaning, then the good does not directly enter the utility function and thus direct effect of this good to the individual's utility function is zero. The house owner hence chooses to produce this good at cost minimization[18] (Huffman, 2010).

Becker's theory of time use is also flawed by its inability to take cognisance of time allocation to leisure activities. The theory incorporates the opportunity cost of time into household decision making with inclusion of market and non-market time without examining the effect of leisure time on household decisions. This weakness reduces its applicability to empirical analysis of leisure time effects on labour supply. For instance, studies examining the effect of illness on labour supply may be able to directly make use of this theory except with adjustment in the theoretical assumption by inclusion of leisure in the household utility maximising framework (Machio, 2012; Bridges and Lawson, 2008). The theory does not provide detailed examination of the trade-offs between leisure, market and non-market time.

[17] The house owner can jointly produce both goods by hiring labour. In this case, production of one good does not directly enter the house owner's utility function**.** The house owner hence minimises cost of hiring labour. In this case, the good does not directly enter the utility function and time spent by house owner producing t1 and utility from t1=0
Where the house owner does not enjoy doing laundry for instance, then increase in variable input such as time spent for production will not result to equal increase in output. This violates the assumption of constant returns to scale (CRS).

[18] Huffman (2010) provides a detailed framework that describes a case of joint production of the goods in the Becker theory of household production.

Schultz and Tansel (1997) made use of Becker's theory without recognition of leisure time as an alternative time use. This study assumed a single period utility function of an individual; maximised over his/her lifetime. Unlike Becker's specification, the utility function was adjusted with the inclusion of current health, non-health consumption and time allocated to wage income. This adjustment enabled specification of the wage and labour supply equations used in the study.

Becker's theory of time use as is the case with household production theories, applies theoretical foundations to household studies as it examines the labour force participation decisions on the household and not on the individual. This limits the framework to household level analysis relative to its applicability in individual level studies. Buchmueller and Valletta (1999) followed similar theoretical framework of the household production theory with focus on husband's health insurance and female labour force participation. This study slightly modifies the empirical specification of Becker's theory with the inclusion of husband's health insurance in the utility function of married females in the United States. Theoretical modifications in this study was based on the premise that women whose husbands have health insurance get reservation wage and hence, may not work at all or choose to be in part time employment because they have access to health insurance for their families.

3.2.2.2 Gronau (1977) Model of Time Allocation

The Gronau (1977) model of household production differs from that by Becker (1965) in that it assumes home produced and purchased goods are perfect substitutes. This theory assumes that a household consumes and obtains utility from two goods, leisure (L) and a good X, say food X_1, which can be produced at home, or X_2 purchased in the market. In Gronau's framework, these goods are assumed to be perfect substitutes, where the household only values total X rather than individual quantities of home produced and purchased X. Where X is given as:

$$X = X_1 + X_2. \tag{3.20}$$

The household utility function; strictly concave, is presented as:

$$U = U(L, X; \tau) \tag{3.21}$$

If the household's production function for X_1 is also strictly concave in one variable input and housework (h_1), it is expressed as:

$$X_1 = G_1(h_1; \varphi) \tag{3.22}$$

Where: φ is a technology or efficiency parameter. The household faces a time constraint, receiving an endowment T in each period allocated to leisure (L), housework (h_1) and wage work (h_2). So that

$$T = L + h_1 + h_2 \tag{3.23}$$

Solving for h_2 from the time constraint equation above, h_2 becomes:

$$\boldsymbol{h_2 = T - L - h_1} \tag{3.24}$$

If the household cash income from wage work (h_2) and non-labour income V, is allocated to X_2, then

$$\boldsymbol{I = Wh_2 + V = P_2X_2} \tag{3.25}$$

Substituting for h_2 (3.24) into the income equation (3.25), yields the household's full-income constraint:

$$F = W \cdot T + V = W \cdot L + W \cdot h_1 + P_2X_2 \tag{3.26}$$

Substituting the production function for X_1 into X which is in turn substituted into the utility function enables choice of h_1 and X_2 that maximizes the modified utility function subject to the full-income constraint;

$$\psi = U[L, G_1(h_1; \varphi) + X_2; \tau\} + \lambda(WT + V - W L - W h_1 - P_2 X_2)] \tag{3.27}$$

The first-order conditions for an interior solution are:

$$L: U_L - \lambda W = 0 \tag{3.28}$$

$$\boldsymbol{h_1: U_xG_1h_1 - \lambda W = 0} \tag{3.29}$$

$$\boldsymbol{X_2: U_x - \lambda P_2 = 0} \tag{3.30}$$

$$\boldsymbol{\lambda: WT + V - WL - Wh_1 - P_2X_2 = 0} \tag{3.31}$$

Combining equations 3.29 and 3.30 provide the amount of X_1 that should be produced under the standard one-variable input profit maximizing condition. The general form of the optimal quantity of housework demanded, h_1, and supply of X_1 is given by

$$\boldsymbol{h_1^* = Dt_1(W, P_2, \emptyset)}$$

(3.32)

and

$$\boldsymbol{x_1^* = G_1(h_1^*, \emptyset) = Sx_1(W, P_2, \emptyset)} \quad (3.33)$$

Equations 3.28, 3.30 and 3.31 can be solved jointly to obtain the demand functions for L* and X_2* expressed respectively as:

$$\boldsymbol{L^* = D_L(W, P_2, V, \tau, \varphi)} \quad (3.34)$$

$$\boldsymbol{X_2^* = D_{X2}(W, P_2, V, \tau, \varphi)} \quad (3.35)$$

Rearranging the time constraint using the information in equations 3.32 and 3.34 gives the general form of the household labour supply equation.

$$\boldsymbol{h_2 = T - L - h_1^* = Sh_2(W, P, V, \tau, \varphi)} \quad (3.36)$$

The model predicts that if non-labour income increases, the household will keep the amount of home produced good unchanged but allocates the extra income to purchase more of the market good X_2 and leisure. However, if P_2 increases, the real wage rate (W/P_2) falls and this motivates an increase in the amount of time allocated and quantity of home produced goods X_1. The net impact on leisure, hours of work and total quantity of X consumed will be determined by resulting substitution and income effects.

The model also asserts that an increase in the efficiency of producing X_1 at all h, such as training in home production, will increase the amount of time allocated to production of home goods (X_1). This assertion follows that of the human capital theory

about the effect of education on labour force participation. Nonetheless, the theory fails to explain the transmission mechanism from education to labour force participation. The human capital theory provides the connection between education and labour force participation through the signalling effect of education which motivates workers' labour supply hours due to unobserved work ethics of the educated individual.

Gronau's theory of household production basically follows a framework where the house owner purchases other goods produced. This apparently becomes an extension of Becker's theory; however the use of either theory depends on assumptions made relative to an empirical study.

In general, the household production theory suggests the use of an aggregated family utility function which may not be realistic. This culls from the fact that household members and household heads may not behave in an altruistic manner (Stoep, 2008). Household heads for instance, may exert power over women in the household by not allowing their wives to engage in market work. This shows that gender bias rather than relative production accounts for participation in market and non- market activities. Regardless of the limitation of the household production theory, general application of the framework has been considered in studies that incorporated parental decisions on child health, husband's health insurance and child bearing on female labour force participation or employment decisions (Rosenzweig and Schultz, 1982; Buchmueller and Valletta, 1999; and Stoep, 2008).

3.3 Methodological Approach to Labour Force Employment

Employment decision is generally considered as a binary choice variable assuming the value of 1 for participation or being employed and zero otherwise. There are three approaches considered in the analysis of a binary choice dependent variable. These include the use of a linear probability model (LPM), logit and probit model (Gujarati, 2004; Sichei 2008). These model types are grouped as limited dependent variable models[19]. Limited dependent models generally have continuous dependent variables which are limited in the values they can take (Eakins, 2013).

[19] The Tobit model is also a type of the limited dependent variable model used for censored or truncated data Y is censored when we observe X for all observations, but we only know the true value of Y for a restricted range of observations. For instance, intervention of the Central Bank to ensure that exchange

The LPM follows the Bernoulli probability distribution. In this case, the conditional probability of an event Y occurring given X must lie between zero and one (Gujarati, 2004). The non-existence of the normality assumption in the LPM is not considered as key deterrent to the use of the ordinary least square (OLS) estimation technique. This is because the OLS point estimates will remain unbiased (Gujarati, 2004). However, the use of OLS in LPM does not guarantee that the probability of an even occurring will yield results that lie between zero and one. The use of the logit and probit models solves the problem of OLS estimation for the LPM. The logit and probit models provide some assurance that the estimated probabilities will lie between the logical limits of zero and one (Gujarati, 2004).

Specification of Y_i binary outcome as a linear function of X posits the existence of an underlying latent index Y_i related to X_i via

$$Y_i^* = \beta X_i + \varepsilon_i \quad (3.37)$$

Where: εi is usually independently and identically distributed (iid). The index Yi* is not observed but instead is assumed to be generated by $Y_i = 1$ iff $Y_i > 0$ and $Y_i = 0$ iff $Y_i < 0$

Such formulation enables X have a linear effect on Y*. The values of X can range from minus to plus infinity while the outcome variable takes on only two values 0 and 1. This structure lends itself naturally to the maximum likelihood (ML) estimation technique (Greene, 2003).

The Probit model assumes a normal distribution with f (ε_i) having zero mean and constant variance. Thus, in a probit model, if an observation has Y_i=1, it must be true that $\varepsilon i > -\beta X_i$.. The likelihood of this occurring is:

$$\boldsymbol{L_i = (1 - \varphi(-\beta X_i)} \quad (3.38)$$

Where: φ is the cumulative density function of a standard normal distribution.

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rate does not exceed a particular threshold implies that there will be no data for say income for higher exchange rate. This data is censored from above. Similar case applies to censored data from below. Y is truncated when we only observe X for observations where Y would not be censored. In this case we do not have a full sample for {Y, X}, we exclude observations based on characteristics of Y. For instance, where family income (y) has no values below N2, 000 but has for above this value we may have no information about the family's characteristics below this value. See Cai *et al* (2008) for one of the several applications of the tobit model.

By the same reasoning for an observation with Y=0 its likelihood must be just $\varphi(-\beta X_i)$. Hence, the likelihood of an individual observation is expressed as:

$$\boldsymbol{L_i = (1 - \varphi(-\beta X_i)^{Y_i}(\varphi(-\beta X_i))^{1-Y_i}} \quad (3.39)$$

The log likelihood of an individual observation is therefore:

$$\boldsymbol{Log\ (L_i) = Y_i Log(1 - \varphi(-\beta X_i) + (1 - Y_i) Log(\varphi(-\beta X_i))} \quad (3.40)$$

For a logit regression the likelihood of an individual observation is given by:

$$\boldsymbol{L_i = (1 - F(-\beta X_i)^{Y_i}(F(-\beta X_i))^{1-Y_i}} \quad (3.41)$$

Where: F, is the cumulative density function of the logistic distribution. The probit model is based on the assumption that the data has a standard normal cumulative density function while the logit model rests on the assumption of the cumulative logistic function. Choice of underlying assumption of the data distribution used in any study depends on convenience of usage. The difference in the estimates of both regression types is seemingly quite minimal (Gujarati, 2004). Most studies examining health effect on labour force participation commonly make use of a ML estimation technique. This is because the latent outcome of labour force participation lends itself naturally to such estimation technique (Stern, 1989; Bridges and Lawson, 2008; Machio, 2012; Cai, 2007).

3.4 Theoretical Foundation to Illness Cost

The onset of illness compels individuals to seek medical care, incurring costs which may be direct or indirect. The desire to be healthy draws from the satisfaction derived from consuming good health and the market return of being healthy which could be measured using wage rate or labour productivity in a perfect market situation. In this light, Grossman (1972) shows that individuals will invest in health until the marginal return of gross investment in health capital equals the marginal costs of such investment. A conceptual framework that elucidates how illness or disease affects individuals and the households show that the desire to be healthy may introduce borrowing to cater for illness expenses which could induce poverty and poor welfare conditions. This framework is depicted in Figure 3.2.

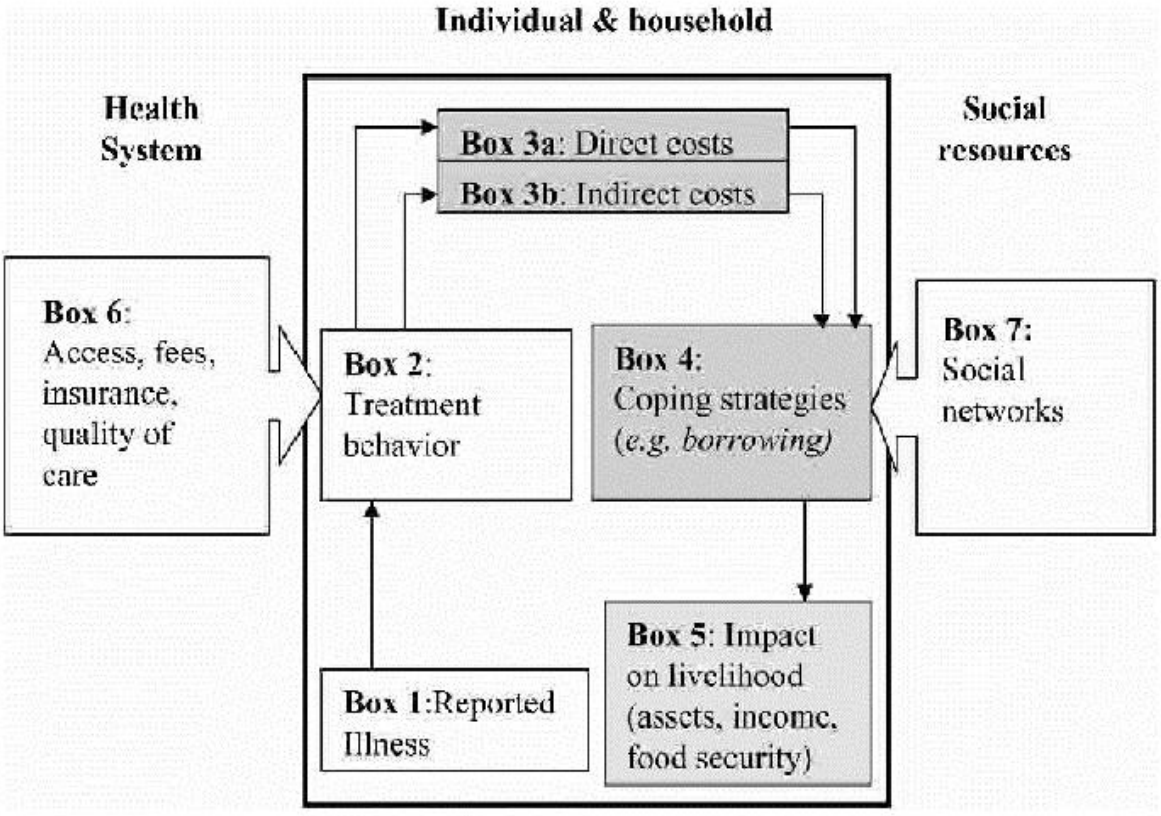

Figure: 3.2 Economic Impact of Reported Illness on the Individual and Household
Source: Russel (2004)

As shown in the Figure 3.2, reported illness may lead to incurring costs which could be detrimental to household living conditions through sales of assets, reduced income and food security. Several coping strategies therefore adopted by the household aside borrowing or asset sales could be in the form of social networks such as financial support from families and friends or remittances from abroad. Illness reported could also influence efficiency of labour in the workplace. This is associated with reduction in work hours or work days or the number of labour employed in the case of mortality from illness (Joel and Segel, 2006; Cai *et al* 2008). This is an indication that reported illness do not only bring with it direct costs but also indirect costs or productivity losses.

McLinden (2013) conceptualises direct costs of illness as financial costs associated with medical treatment and provision of healthcare. Direct costs can therefore be grouped into medical and non-medical. Direct medical costs consist of cost of hospital stays, outpatient visits, drugs and medical devices used for the treatment of an ailment. Direct non-medical costs include travel cost to obtain health intervention, time spent by patients and their family caregivers in relation to illness (Zhang *et al* 2013)

Indirect costs comprise loss of resources due to morbidity and mortality from illness. Hence, it places a value on life which may be controversial based on ethics (Joel and Segel, 2006). Indirect costs also denote productivity losses due to illness. It is measured as costs associated with days absent from work or losses associated with inefficiency at work, referred to as work disability, presenteeism or workers' incapacitation (Joel and Segel, 2006). Productivity losses are sometimes calculated by multiplying the cumulative number of missed workdays by a daily salary (Koopmanschap and Rutten, 1996). Some studies had made use of loss in wages or income due to ill health as a proxy for productivity losses (Ghatak *et al* 2011; Zhang *et al* 2013). However, where teamwork is involved, productivity losses may exceed wage rates because the absence of a worker will drastically affect output or wages (Zhang *et al* 2013). Other forms of indirect costs from illness are non-monetary. They include; pain, suffering, and discomfort. These are not considered as economic costs. They are however, reflected in illness morbidity which results to inefficiency of labour on the job otherwise known as presenteeism (Zhang *et al* 2013).

Cost of illness studies employ two epidemiological approaches; prevalence-based and incidence- based studies. Prevalence-based studies determine illness costs based on the total number of existing cases in a pre-defined period of time. Such studies usually include a cross section of cases that may have acquired the disease at different points in time. It is suitable for conditions that remain relatively stable over time. The time period over which costs will be measured is specified and may vary by illness type (McLinden, 2013). Incidence-based studies on the other hand, refer to costs associated with the number of new cases in a predetermined period of time. Such studies are usually concerned with the lifetime costs related to an ailment (McLinden, 2013).

3.5. Methodological Approach to Estimating Cost of Illness

Several approaches have been adopted in economic literature for estimation of direct and indirect costs of illness. Detailed examination of these approaches is considered in the sub-sections below;

3.5.1 Estimating Direct cost of Illness

Three basic methodological approaches have been identified in estimating direct cost of illness. These are: the top down approach (TDA), the bottom up approach (BUA) and the econometric or incremental approach (ECA) (Joel and Segel, 2006, McLinden, 2013). The TDA, otherwise referred to as the aggregate or gross costing approach requires allocation of portions of known total health expenditure to a class of diseases based on the severity of the ailment group. This method was developed by Rice (1967). It consists of allocating total national healthcare expenditure by type of care among 16 1nternational classifications of diseases (ICD) categories. This approach hence makes use of specific codes that characterise the severity group of the disease and from a large expenditure database and specifies what is expended on the illness category. The approach ensures no double counting of costs of illness particularly for illnesses that have relative risks of inducing another disease. (McLinden, 2013). The TDA is hence insensitive to variability between patients because the relationship between the state of the ailment and resource use is modelled on a combined scale ((McLinden, 2013). The TDA makes use of aggregated data with a population attributable fraction (PAF) to calculate the cost associated with exposure to the disease. The PAF was developed by Morganstern *et al* (1980) and is given as:

$$PAF = P(RR-1) / [P(RR-1) + 1] \quad (3.42)$$

Where P represents prevalence of disease A and RR represents unadjusted relative risk of contacting disease B for persons having disease A. This approach has been applied mainly in developed economies as they have available database and severity category of diseases with specified codes and proportional health expenditure.

The BUA otherwise known as the micro costing approach estimates illness costs associated with a particular treatment or service and the number of times the ill individual uses or requires such treatment. (McLinden, 2013). This approach requires identifying individuals with the disease of interest either from person-based data or sources that provide individual cases. All units of health care used by a patient and cost incurred for each unit are determined. Total direct cost of illness is then computed by summation of all unit costs. Mean per person costs can then be extrapolated to the whole population using incidence or prevalence data (McLinden, 2013). The BUA is a person-based estimation method and allows for greater detail of analysis and hence reflects differences in costs between patients depending on the state of the disease.

The ECA estimates the incremental difference between a cohort of the population with the disease and the cohort without the disease. Both cohorts are then matched using regression analysis by various demographic characteristics such as age, sex, race, and geographical location. The ECA is estimated using the mean difference approach or the multiple stage regression approach. The mean difference approach compares the mean costs incurred by each of the cohorts to determine the incremental difference attributable to the disease of interest. This approach usually adopts the use of costs per case of the disease (Swensen *et al* 2003). The multiple stage regression is used for a large number of cases with zero cost of treatment and few cases with very high costs. The incremental cost of the disease is measured comparing the regression estimate with the disease dummy variable turned on to the regression and the estimate with the disease dummy variable turned off. The multiple stage regression often uses a two-stage regression. It is used to estimate the likelihood of individual receiving any care and the excess of care received.

3.5.2 Estimating Indirect Cost of Illness

Several theoretical approaches have been identified in the literature explaining the methodology involved in analysing indirect cost of illness. These include; the production function approach (PFA), the willingness-to-pay approach (WTPA), the human capital approach (HCA) and the friction Cost Approach (FCA) (Olalekan *et al* 2013; Filipovic *et al* 2011). Studies adopting the PFA are usually based on macroeconomic analysis of the economic burden of diseases or poor health status. Such studies commonly adopt the augmented Solow model to capture the effect of ill health on economic growth and total factor productivity (TFP) (Gallup *et al* 2001; Ahuja and Wendell, 2009; Cole and Neumayer, 2005; Asante and Asenso-Okyere, 2003; Bloom and Canning, 2005). Bloom and Canning (2005) however made use of the PFA in a micro study analysis measuring wage rates using per capita income and health status using adult survival rates as it closely reflects the health status of the working population. The model specified for the micro study with underpinnings of the augmented Solow framework had the features of the Mincerian wage equation. Most studies adopting this approach measures health effects of TFP using various measures of health status such as mortality rates, life expectancy, falciparium malaria index and prevalence rate of diseases (Gallup *et al* 2001; Bloom and Canning, 2005; Cole and Neumayer, 2005).. Based on the underpinnings of the Solow framework, most of these studies have found that poor health status reduces economic performance.

The WTPA quantifies the amount an individual is willing-to-pay to reduce the probability of contacting an illness or an undesirable health outcome and the risk of mortality (Salihu and Sanni, 2013). The machinery for determining how much individuals are willing to pay includes survey studies, examining additional wages for high risk jobs or examining the demand for products that lead to improvement in health and safety (Joel and Segel, 2006). Such safety products could include; the use of mosquito treated bed nets, condom use and seat belts. This approach requires individuals to state the maximum amount they would be willing to pay to acquire a service or prevent infection from a disease (Jimoh *et al* 2007). However the amount an individual is willing to pay depends on his/her income and financial values. In other words, the results are income sensitive. This approach has also been criticised on the basis that respondent's interpretation of questions may be biased if they desire to engage in strategic behaviour (Sachs and Malaney, 2002). The WTPA however has the

strength of analysing intangible costs associated with disease via willingness to pay to avoid pain and suffering. Costs associated are hence expected to be higher than those from the HCA which ignores intangible costs.

The HCA is the most commonly used approach in cost of illness studies (Filipoviv *et al* 2011; Joel and Segel, 2006). The approach quantifies potential productivity losses due to illness in terms of forgone earnings assuming full productivity. The approach is based on the premise that individuals produce a stream of output over the years that are valued as individuals' earnings and the individual's rate of pay is assumed to be equal to the value of a person's labour activity. Hence the HCA measures indirect costs by placing a monetary value on the worth of life. This approach places a lower value on the elderly and non-working groups than the young and working group. (Joel and Segel, 2006).

Analysis of productivity losses associated with mortality or permanent disability is determined by the HCA using the product of earnings lost at each age and the probability of living to that age (Joel and Segel, 2006). The approach requires conducting original surveys to estimate rates of disability and lost work time for specific disease. The HCA has been criticized for ignoring intangible costs such as pain and suffering; underestimating illness costs. The approach also fails to capture productivity losses from the firms' perspective. It ignores losses to the firm or costs associated with the replacement of a worker. Such costs include expenses incurred in searching for a new employee and training the new staff. This led to the introduction of the FCA (Filipovic *et al* 2011).

The FCA considers cost associated with productivity loss from the time of workers absence from work due to ill health through the period of searching, recruitment, training and replacement of the sick worker (Frick and Gower, 2007; Filipovic *et al* 2011). This is known as the friction period and it depends on the flexibility of the labour market and degree of unemployment. The FCA is more related to the employer and is argued to better capture productivity losses to the society (Frick and Gower, 2007; Fillipovic *et al* 2013). The approach is occupation specific and is not clear about what happens to the productivity of an individual who is absent repeatedly and unpredictably (Frick and Gower, 2007).

The literature identifies three other distinct approaches to assigning costs to illnesses. The first is an encounter-based method in which spending is attributed to one or several diagnoses as shown by data extract from patient claims for that one encounter. A second approach, constructs episodes of treatment by estimating the spending on all services considered to be involved in the diagnosis, management, and treatment of a condition. An episode may have different lengths of time. The third method takes a person-based approach, tracking individuals for a set period of time (often one year) and then attributing each individual's spending to different disease treatment (NAS, 2010). Costs are expressed per episode, per month, per year, per capita household spending, average daily output per adult, or income lost for each respondent due to disease (NAS, 2010).

3.6 Empirical Literature Review

One major channel through which illness influences economic output is through labour contribution to economic outcomes. This assertion can be justified on the basis that the quality of labour used in production affects the productivity of other inputs in the production process such as capital and technological advancement. Umoru and Yaqub (2013) had shown that a country's ability to raise economic output depends largely on the quality of the labour force.

Apparently, the relationship between illness and economic performance could work through the human capital component of labour which drives labour productivity. Human capital was initially conceived to comprise only knowledge capital nonetheless, with the role of health capital in human capital development, for instance, in the cognitive and learning ability of individuals has informed the recognition of health capital as a vital component of human capital (Mushkin, 1962, Becker, 1964; Fuchs, 1966; Grossman, 1972;). Knowledge capital as a component of human capital influences economic outcomes through the accumulation of skills and unobserved characteristics of labour such as work ethics and intrinsic innovation, acting as a signal effect of education. Grossman (1972) showed that illness could induce a fall in labour market supply in terms of a reduction in work hours as some days would be lost to illness. This translates to a reduction in the discounted present value of lifetime wealth of the individual as earnings over the lifetime also falls. This suggests that the presence

of diseases in a population reduces labour productivity and labour supply hours in an economy.

3.6.1 Illness and labour force participation

The deteriorating effect of human capital on development due to the presence of illness and the apparent undesirable consequential effect on economic performance motivated the majority of studies that examined the effect of illness on economic variables. This is particularly due to cost burden and reduced labour contribution to economic output. Most studies examining the effect of illness either at the micro or macro level basis, generally find non-positive effects of illness on economic variables (Martin and Drabo, 2013; Dauda, 2012; Alaba and Alaba, 2009; Machio, 2012; Gallup and Sachs, 2001; Cole and Neumayer, 2005).

In the literature it is shown that the existence of poor health; most likely due to the presence of illness could influence labour choice and sector employment. For instance, Bridges and Lawson (2008) and Machio (2012) examined poor health effects on economic outcomes for Uganda and Kenya respectively, show that poor health do not only reduce labour force participation but also reduces the likelihood of individuals participating in paid employment or formal sector employment.

Studies that have examined the economic consequence of diseases in the literature make use of prevalence rate of the ailment, health indicators or disability forms related to the disease to measure health status (Gallup and Sachs, 2001; Stern, 1989; Machio, 2012; Dauda, 2012; Banerjee *et al* 2013). Among the measures of health status used in the literature, Stern (1989) argued that the use of illness disability is a most preferred option particularly when considering the health effect of illness on labour force participation. This is because disability shows the extent to which illness limits the amount or kind of work that can be done by labour. Illness disability determines the working capacity of labour which influences productivity and participation.

Studies have generally shown that the role of health on employment decision is bidirectional or jointly determined (Stern, 1989; Barnejee *et al* 2013; Bridges and Lawson, 2008; Machio, 2012; Gannon and Nolan, 2003; Cai and Kalb, 2004). Work pressure and excessive labour hours along with the nature of work environment can increase labour vulnerability to illness. On the other hand, illness affects labour force participation through inefficiency of labour in the workplace, reduction in the work hours or work days and sometimes reduction in the size of the labour force particularly in the case of mortality from illness. The bidirectional relationship between health and labour force participation accounts for one form of endogeneity in health and labour force analysis. Other forms of endogeneity are due to rationalisation and measurement errors. Rationalisation endogeneity is associated with the use of self-reported health status. This is because self-reported health is usually not clinically determined hence, such measure may be correlated with socioeconomic status. Individuals may alter their reported health for economic or psychological reasons to rationalise their labour market decisions (Machio, 2012). This produces biased results in economic analysis (Suhrcke *et al* 2008). The case of measurement errors in health surveys relates to poor understanding of respondents to the questions asked. Stern (1989) for instance showed that some individuals with obvious disability due to poor health respond that they do not have health limitations. Such a response points to the fact that respondents do not understand the questions asked possibly because the questions are unclear. Again unobserved individual characteristics that affect health such as time and risk preferences affect labour force participation decisions and can lead to biased estimates due to endogeneity.

Bridges and Lawson (2008) had shown that the problem of endogeneity especially in connection with self- reported health can be better addressed by listing the type of illness. Acknowledging the particular type of illness experienced reduces errors in terms of reporting that an individual is in poor health with no consideration of the nature or type of illness driving reported health. It also prevents the interviewer from having to guess what ailment is associated with a particular symptom. This approach only deals with the problem of measurement errors in health surveys. Other causes of endogeneity such as unobserved factors and bidirectional relationship between the prospective endogenous and explained variable are not considered.

In the literature, empirical determination of the existence of endogeneity is generally carried out using the Hausman test (Hausman, 1978) or the Wald chi-square test (Wooldridge, 2002).The health variable is endogenous if and only if the error term in the structural and reduced form equation are correlated or iff the error term in the reduced form equation is statistically significant as an explanatory variable in the structural model (Mason, 2013). Hausman test statistics are usually reported when conducting endogeneity tests using OLS estimation technique.

In addition to the Hausman test, Stern (1989) experimented with two more tests of exogeneity. These include the Wald test, using the ML estimation technique and the statistical significance of the effect of participation on the health variable. Test of the significance of labour force participation in an equation with health as the dependent variable, provides inkling to endogeneity due to bidirectional relationship between health and labour force participation.

Studies generally address existing problem of endogenity using instrumental variables. (Stern, 1989; Machio, 2012; Bridges and Lawson, 2008). The use of instruments is conducted in a two stage technique using OLS or ML estimation. In the two stage estimation, the first stage regress a set of exogenous variable on health and the second stage replaces the health variable with its predicted value from the first stage. The two stage estimation using OLS has been criticised on the basis of partial test of exogeneity because only the coefficient of the labour force participation variable is estimated and the correlation coefficient is assumed to be zero. It does not account for potential error between the error term in the structural and reduced form equations (Cai and Kalb, 2004). Hence, such control measure produces consistent but inefficient parameter estimates. This limitation is overhauled with the full information maximum likelihood (FIML) estimation (Cai and Kalb, 2004). It is shown that the FIML technique corrects for the limitation of the two stage instrumental variable technique. It conducts tests for correlation in the structural and reduced form equations and for significance of the coefficient of the labour force participation variable in the health equation and the health variable in the labour force participation equation (Cai and Kalb, 2004). Barnejee *et al* (2013) used a different approach to address the potential endogeneity between mental illness and labour force participation. Using covariance instruments as suggested in Lewbel (2012). The advantage of this approach is that it does not require

questionable exclusion restrictions for identification. It is applied when there are weak or unavailable instruments for the endogenous variable.

Studies applying the instrumental variable technique to correct for endogeneity between health and labour market outcome have used instruments such as distance to the nearest health facility with a doctor, distance to the nearest weekly market or distance to the nearest daily market (Machio, 2012; Fred *et al* 2012; Bridges and Lawson, 2008; Cai *et al* 2008). The variable chosen as an instrument for the prospective endogenous variable must satisfy three conditions before adoption in any analysis. First, it must be statistically significant in explaining the variable instrumented. Second, the magnitude of its explanatory ability of the variable instrumented must be large and third, the instrumental variable must not be correlated with the structural error term[20] (Machio, 2012).

Fred *et al* (2012) had adopted the two stage instrumental variable technique in the study of health and labour market outcomes in Uganda. This study reported more significant effect of ill health on labour force participation when endogeneity is controlled for. This suggests that the problem of endogeneity is crucial for consideration in analysis involving self-reported health status.

Literature findings of health effect on labour force participation have commonly being negative (Gannon, 2005; Cai and Kalb, 2004; Machio, 2012; Bridges and Lawson, 2008; Cai *et al* 2008). Overall, a person's health status influences and is influenced by labour force participation. Results of the study by Cai and Kalb (2004) showed that better health increases the probability of labour force participation for all age groups. On the other hand, labour force participation has significant positive effect on the health of older females and significant negative effect on younger male's health. Younger females and older males showed insignificant effect of labour force participation on health.

[20]Correlation of selected instruments with the structural error term is determined using over identification tests. The Sargan (1958) tests have been commonly applied for such tests particularly in panel data estimations and models with dynamic panel specification (see for instance Cole and Neumayer, 2005; Ke *et al* 2011) The Amemiya chi-square tests have also been used to conduct over identification tests. The Amemiya chi-square tests are obtained as by-products of Amemiya's generalised least square procedure in simultaneous equation models with limited dependent variables (Lee 1991). The Amemiya general method for estimation of structural parameters was introduced by Amemiya(1978, 1979, 1981)

Gannon and Nolan (2003) using quarterly national survey data in a maximum likelihood probit model showed that individuals who reported being hampered in daily work due to disability from illness reveal negative impact of health on labour force participation. Persons who do not report disability from illness showed no significant effect of health on labour force participation. In this study, working age men reporting illness disability were shown to be 60% less likely to be active in the labour force. Women showed a lower statistics of 40% less likelihood of participation in the labour force. This shows that illness disability has stronger effects on labour participation of males than females.

On the role of health in labour market outcomes, Cai *et al* (2008) examined the effect of health and health shock in Australia. Using a dynamic random effect tobit model, results of the study suggest that health shocks makes individuals reduce labour supply by minimal amounts rather than leaving the labour force. This study allows for the possibility that people who experience health shocks may not choose to leave employment altogether but may instead choose to stay in employment with reduced working hours. The study did not trace any major difference in the effect of health status and health shocks on the working hours of men and women. The tobit model was used in this study because it allows for analysis of leaving work or reducing work hours to control for bunching of responses around zero work hours. Inclusion of household size in the labour force participation equation may have yielded a different outcome for health and health shocks effect on labour decisions of men and women. This is because for a developed economy like Australia, work time and home time substitute for one another, especially for female working individuals.

In Kenya, Machio (2012) examined chronic illness effects on labour market outcomes in Kenya using the 2005/2006 integrated household budget survey. This study slightly modifies the household decision-making theory with the inclusion of leisure in Becker's (1965) model. Based on the examination of chronic illness effects on preference of employment type, the study adopted the multinomial logit framework. The findings of the study showed that poor health reduce labour force participation by 65% and hence lowers the probability of participation in the workforce. It also deters entry into wage employment and agricultural employment particularly for women. Presence of children five years of age and below in a household reduces the likelihood

of women participation in wage employment but increases participation in non-agricultural self-employment. Similar finding applies to the men with small magnitude. This is expected as self-employment activities unlike formal work type, is not a substitute for home production. This study also draws attention to gender differences in labour supply decisions. The study showed that women, particularly married females have less likelihood of participation in the labour force. This phenomenon can be explained based on females having a high reservation wage; an alternative source of income from their husbands and hence are likely to spend less labour hours than males (Buchmuller and Valletta, 1999; Glick and Sahn, 1997). Findings from the study indicate that older persons are more likely to report chronic illness. Interaction of the response to chronic illness and age would have provided further support or not to the assertion that the effect of chronic illness on labour participation is higher for older persons than for those who are young.

Bridges and Lawson (2008) using the Ugandan national household survey of 2002 to 2003 also show negative outcome between an individual's health and labour supply decisions. This study showed that ill health lowers the likelihood of being in the formal labour market, especially for women. Number of children also negatively affects women participation in paid employment. One outstanding finding in this study is that education particularly secondary has a positive effect on the likelihood of participation only in paid employment for men. Hence, education effect on participation is limited.

Swaminathan and Lillard (2000) model health as a latent variable to predict the effects of health on wages and labour market outcome in Indonesia using the Indonesia family life survey. This study made use of a likelihood function under a probit framework. Results of the study suggest that health has strong effect on participation which is halved when wage rate is controlled for. Contrary to expected result for the effect of higher educational attainment on labour participation, the study showed that individuals with higher educational qualification are less likely to participate in the labour force after controlling for health and wage. The study considered the direct effects of health on labour force participation and the indirect effects operating through the effect of health on wages.

3.6.2 Empirical Studies on Determinants of Labour Market Outcome

In examining variables that influence labour market outcomes, Fadayomi and Ogunrinola (2011) focused on the influence of household structure on labour participation decision in Nigeria, using data from the defunct National Manpower Board in 2005. The theoretical underpinnings of this study followed the traditional neoclassical theory modified with the inclusion of household production decisions. Age, education, being married and southern residence was shown to raise the probability of labour participation. However, residence in the urban area was seen to reduce participation probability. The study found no significant contribution of household structure to the level of labour force participation in Nigeria. This study failed to recognise that the highly informal nature of the Nigerian labour force reduces substitution possibilities of market and home production such that household structure may not significantly affect labour force participation or employment decision.

Aminu (2010) considered the determinants of labour force participation and earnings in wage employment in Nigeria. The findings of this study showed that education is a key determinant of participation. Other determinants of labour force participation of an employable household member include ownership of assets such as home ownership, residence particularly urban residence as well as household size and number of young children. This study showed that home ownership reduces probability of participation in the labour force. Urban residence increases significantly the probability of male participation in wage employment except in incorporated private sector organisation. Household size increases significantly the probability of participation in private sector wage employment and also the probability of male participation in public employment. Living with young children aged 2 to 4 years significantly reduces probability of female participation in public wage employment but does not affect it in private wage employment. On the other hand, it increases the probability of male participation in informal private sector employment. One reason that accounts for none effect of the presence of young children in private wage employment particularly for females is premised on the fact that the informal labour market; a basic feature of developing economies requires no trade off of home time and work time in market and non-market activities. Thus, women participation in the labour force may not be affected significantly with the presence of young children. Increased male labour force participation with the presence of young children can be associated with financial

demands particularly due to rising family needs given high fertility rates in most developing economies like Nigeria.

Smith (1981) on the determinants of female labour force participation in Mexico showed that household structure has no influence on their participation particularly in the traditional sector. This conclusion buttresses arguments that the number of children does not affect female labour force participation especially for developing economies. Some work types in the informal setting such as tending a small store at home can be performed simultaneously with childcare. Further findings in this study showed that increase in wives wage potential, for instance, education and health stock simultaneously promote greater participation; this possibility is in the modern sector.

Using National Household Survey data in Chile, Contreras *et al* (2010) considered the determinants of labour force participation in a utility maximisation framework. Individual choices to work or not were based on a number of variables that enter the utility function. Education, age, number of children and household structure as determinants of labour force participation, showed similar findings to other studies in the literature. For instance, increase in years of schooling raises the probability of participation particularly for those with at least 12 years of schooling. An increase in the number of children raised male participation but decreases female labour force participation. This influence was not examined in terms of formal or informal sector employment of females. One variable included in this study which significantly influences labour force participation is household income. Participation in the labour force falls with increase in income, especially for affluent households. This finding corroborates the labour-leisure trade off of the neoclassical theory of labour supply. This theory predicts that with dominance of income effect over the substitution effect of a rise in non-labour income, an increase in wage rates makes individuals prefer to work less time and raise leisure hours (Durnel, 2010). The influence of age on labour force participation is also shown to be non-linear in this study. Labour force participation rises with age in a non-linear fashion for males and females and is notably higher in the urban than in the rural areas.

The omission of the health variable as an important determinant of labour force participation in some studies (Fadayomi and Ogunrinola, 2011; Aminu, 2010; Smith, 1981; Contreras *et al* 2010) is a lopsided assumption of the role of human capital in

labour supply decisions and earning ability of labour. Predictions of the human capital theory specifically by Grossman (2000) showed that health is an important component of human capital which determines the number of days available for market and non-market activities. Ill health determines whether an individual is employed or not in the labour force.

Stern (1989) examined the effect of poor health on labour participation decisions by grouping illness disability in three measures. One form relates to whether health limits the amount or kind of work done by labour. The answer to this question is termed limits (Yes=1, No= 0). Another measure of disability relates to the rating of health status, where for instance, excellent health = 0, good health=1, fair health=2 and poor health=3. The third measure considers health in relation to symptoms termed conditions such as weakness, seizures and mental retardations. The second and third measures are together termed the health question. Experimenting with each of these measures of illness disability shows preference for the use of the limit variable as a measure of health. The limit variable shows marginally better results as it explains more of the variation in the data than the health question. The health question theoretically confounds the pure age effect with a disability effect. Both measures should be used when available because they have independent and significant effects on labour force participation (Stern, 1989).

3.6.3 Empirical Findings on Illness Costs due to Malaria

In Africa, most studies which examined the effect of illness on the economy have mainly examined it in relation to cost burden. Dimensions of costs examined are in terms of direct costs, productivity losses and proportion of economic output lost to the disease (Saliu and Sanni, 2013; Kioko *et al* 2013; Okorosobo *et al* 2011; Alaba and Alaba, 2009; Etiaba *et al* 2015). These studies have also focused solely on illness costs burden associated with malaria. This is because in tropical and subtropical regions of Africa, particularly SSA, malaria is noted as the most common ailment and significantly drive up poverty and poor economic growth (Gallup and Sachs, 2001).Direct cost estimate for a bout of malaria in Africa amounts to over US $12 billion annually and drags economic growth by more than 1% per year (UNICEF, 2004).

A study conducted in Kenya had shown that individuals who have malaria earn less than those without the ailment. This study showed that persons with malaria infection earn 44% lower wage income than those in good health, particularly due to morbidity effect of the illness (Kioko *et al* 2013).

Another study examined illness costs in Nigeria with the use of the BUA. Findings of the study showed that total direct and indirect costs due to malaria in rural parts of Oyo state amounts to approximately ₦357.21 and ₦7, 743.37 respectively (Alaba and Alaba, 2009). Total costs for malaria was further extrapolated to the state population and shown as approximately 10% of GDP. The direct and indirect cost figures shown in the study appears worrisome when examined with rising poverty rates in Nigeria. For instance, in 2004, about 51.60% of the Nigerian population were living on less than US $1(₦107.07)[21] per day. In 2010, the figure had risen to approximately 61.25% (NBS, 2012).

Etiaba *et al* (2015) examined direct cost of malaria in relation to coping mechanisms of households in Nigeria. Findings of the study showed that households pay mainly through out of pocket for all expenditures related to the illness. Effect of the illness shows devastating effect on household welfare in terms of reducing household savings (79.5%) and other expenditures (22.5%).

Results of a study by Jimoh *et al* (2007) had shown that Nigerian households are willing to pay as much as ₦7, 323 (US $61) for the control of malaria per month which is in excess of ₦2, 715 (US $22.6) per month of what they bore. The morbidity and repeated nature of the illness is costly to income prospects and could account for why households are willing to pay more for the prevention of the illness than to suffer from the cost burden. An extrapolation of the cost Nigerians are willing to pay for malaria control translates to about 12% of the country's GDP. The NBS (2010) show that some Nigerians who report being sick with malaria do not seek medical attention due to the high treatment cost. One implication of such action is a further deterioration of health status which jeopardises participation in the workforce and increases the risk of poverty and economic dependence.

[21] The exchange rate value used is the average nominal and effective exchange rate; computed using the 2003 base period for indices. In 2010, US 1$ was ₦96.88. This was computed using the 2009 base period for indices (see CBN, statistical bulletin, 2014)

Findings on household willingness to prevent malaria illness are also buttressed by Onwujekwe *et al* (2014) with evidence of high ownership and use of Insecticidal treated nets (ITN) in Enugu state. From a sample of randomly selected households, ownership and use of ITN were as high as about 73% and 71.2% respectively. The study showed higher preventive behaviour for rich than poor persons especially in terms of expenditure on window and door nets.

3.7 Summary of literature findings

Overall, studies have shown significant effects of health status on labour market outcome and commonly examined health status with indicators such as life expectancy and mortality rates. Some studies have also made use of symptoms of poor health, disabilities associated with reported health as well as chronic illnesses to capture poor health status. Little attention have been directed to the effect of communicable illness especially malaria on labour market outcome. This is imperative given evidence that malaria significantly influences health status indicators in countries with high prevalence. This dimension of illness effect takes policy makers attention away from chronic illness on labour market outcome to communicable illness. The approach extends literature findings and will better equip policy makers with information that will enhance the labour force in relation to human capital composition particularly in developing economies like Nigeria with highest country figures of malaria cases.

In addition, studies have examined cost computations of malaria with neglect of income fraction spent for treatment. Computations of costs do not provide direct estimates of welfare loss in terms of income. Additional findings on cost with reference to income loss provide information on how much of income is forfeited on treatment when individuals experience several episodes of the illness over a period of time.

Analysis of the effect of health on labour market outcome and cost burden of illness are commonly presented for national level and across gender. Consideration of differences of health on labour decisions are ignored in relation with other population strata. Such direction of study provides policy makers with more effective tools in initiating strategic actions on population strata that suffers most from the effect of poor health on labour market decisions.

The relationship between health and labour market decision is considered with only work and leisure time trade-off. The onset of illness includes additional time constraint to the sick individual. This links poor health to labour search for job. In this case, individuals who seek treatment are less likely to be employed as they are not able to search for job or gain employment. This is especially with reference to informal sector economies where physical presence is required for gainful employment.

CHAPTER FOUR

THEORETICAL FRAMEWORK AND METHODOLOGY

4.1 Introduction

This chapter focuses on the theoretical framework adopted in this study. Empirical models and estimation techniques used to achieve the study objectives are also presented in this section. The chapter further presents information on the nature and source of data used in this study.

4.2 Theoretical Framework for Employment Decision

The theoretical framework used in this study for labour employment decision is similar to Huffman's (2010) adjustments to the structure of the traditional neoclassical theory of labour supply. The use of the traditional theory over Becker's (1965) and Gronau's (1977) Household production theories is based on the fact that this study focuses on

individual labour participation decisions rather than the household[22]. Assuming an individual in the economically active population has a strictly concave utility function given as:

$$\boldsymbol{U = U(H, X, L, Z)} \tag{4.1}$$

Where: utility depends on the current health status of the individual (H); consumption of goods and services X (excluding healthcare); leisure (L)[23], and predetermined observable factors (Z) such as educational attainment, gender and place of residence. Intuitively, current health status, consumption, and leisure are positive goods. That is, a marginal increase in any of these goods adds to the individuals utility so that $U_{H,}$ U_X, $U_L > 0$

Assume that the production function for the individual's health status is expressed as:

$$\boldsymbol{H = H(h_g, T_h, X, G, \delta)} \tag{4.2}$$

Where: H (.) is a strictly concave function, h_g is a vector of health inputs or medical care, T_h is time spent seeking good health, G signifies health stock and $\boldsymbol{\delta}$ summarises factors which affect the efficiency of current production of health status. These factors basically include environmental cleanliness, genetic structure and educational attainment[24]. Holding all other factors constant, it is expected that an increase in purchased health inputs or medical care and time spent seeking good health produces better health. That is, H_{hg}, $H_{Th}>0$. The marginal effect of non-health good consumed (X) is expected to be positive for some goods and negative for others[25]. Marginal effect of consuming healthy foods is expected to be positive while consumption goods such as alcohol and cigarette have associated negative effect on health status.

[22] Studies that make use of the framework of household labour supply theories generally focus on subjects that involve family consumption of goods in the utility function. For instance, Buchmueller and Valletta (1999) adopted this theory for husband's health insurance effect on married female's labour supply. See also Rosenzweig and Schultz (1982)

[23] Leisure time represents time spent outside work for relaxation and enjoyment. It is time that is not motivated by illness

[24] Breeding of mosquitoes are common in communities with poor sanitation practise. The individual's genotype on the other hand, influences vulnerability to malaria. Grossman (2000) had earlier shown that educational attainment increases the efficiency of health capital stock.

[25] Consumption of non-health goods such as food items and clothing has positive effects on health status. On the other hand consumption goods such as cigarette smoking and alcohol consumption impacts negatively on health status.

If it is further assumed that the individual's total time endowment T is allocated between leisure (T_L), time spent seeking good health (T_h) and work time (T_{LP}) (participation in the labour force)). Then total time available to the individual T can be written as:

$$\boldsymbol{T = T_L + T_h + T_{LP}} \quad (4.3)$$

Hence, work time is specified as:

$$\boldsymbol{T_{LP} = T - T_L - T_h} \quad (4.4)$$

Let income earned by the individual for each work day be W. From equation 4.4, total income earned for the period spent working (T_{LP}) becomes:

$$\boldsymbol{F = WT_{LP} = W(T - T_L - T_h)} \quad (4.5)$$

If total income earned is allocated to the purchase of health and non-health goods, then

$$\boldsymbol{WT_{LP} = P_1 h_g + P_2 X} \quad (4.6)$$

Where: $\boldsymbol{P_1}$ depicts the price of health goods and $\boldsymbol{P_2}$ represents the price of non-health goods.

From equations 4.5 and 4.6, the full income constraint can be written as:

$$\boldsymbol{F = WT_{LP} = W(T - T_L - T_h) = P_1 h_g + P_2 X} \quad (4.7)$$

Opening the bracket in equation 4.7, the full income constraint can further be written as:

$$\boldsymbol{F = WT_{LP} = WT - WT_L - WT_h = P_1 h_g + P_2 X} \quad (4.8)$$

The expression in equation 4.8 shows that the individual experiences opportunity cost of $\boldsymbol{WT_L \; and \; WT_h}$ when time is spent on leisure and illness respectively. It also shows that the full income received is exhausted on purchase of health goods $\boldsymbol{h_g}$ and non-health goods $\boldsymbol{X}$. The individual therefore chooses, $\boldsymbol{h_g}$, $\boldsymbol{T_h}$, X and $\boldsymbol{T_L}$ that maximize the utility

function 4.1 subject to the full wealth constraint 4.8. The optimization problem is thus stated as:

$$\pi = U(H(h_g, T_h, X, G, \delta), X, L, Z) + \lambda(WT - WT_L - WT_h - P_1 h_g - P_2 X) \quad (4.9)$$

The first-order conditions for the individual's decision problem are:

$$h_g: U_H H_{hg} = \lambda P_1$$
(4.9a)

$$T_h: U_H H_{Th} = \lambda W \quad (4.9b)$$

$$X: U_H H_X + U_X = \lambda P_2$$
(4.9c)

$$T_L: U_L = \lambda W$$
(4.9d)

$$\lambda: WT - WT_L - WT_h - P_1 h_g - P_2 X = 0 \quad (4.9e)$$

Equations 4.9a to 4.9e can be solved jointly to obtain the general form of the individual's demand functions for health, time spent seeking good health, non-health goods and leisure time:

4.9a $h_g^* = D_{Hg}(W, P_1, P_2, G, \delta, Z)$

4.9b $T_h^* = D_{Th}(W, P_1, P_2, G, \delta, Z)$

4.9c $X^* = D_x(W, P_1, P_2, G, \delta, Z)$

4.9d $T_L^* = D_{T_L}(W, P_1, P_2, G, \delta, Z)$

Given the individual's optimal demand for time seeking good health (4.9b) and leisure (4.9d), the general form of the labour supply equation (Lp) of the individual can be written as:

$$T_{LP} = T - T_L^* - T_h^* = L_P(W, P_1, P_2, G, \delta, Z) \quad (4.10)$$

It is apparent that an individual's decision to supply work time implies choice to participate in the labour force. Thus, the specification in equation 4.10 appositely

represents the labour force participation equation. The equation suggests that factors explaining work time or labour participation include wage (W), prices of health input and other goods consumed ($\boldsymbol{P_1}, \boldsymbol{P_2}$), initial health stock (G), factors affecting the efficiency of producing health $\boldsymbol{\delta}$ and observable factors Z.

Due to limitations of data in capturing $\boldsymbol{P_1}, \boldsymbol{P_2}$, this study simply examined the labour participation equation without inclusion of these variables. To enable examination of reported health status in labour force participation, unobservable factors such as initial health stock, genetic composition and environmental factors are assumed to be subsumed in the possibility of the individual reporting malaria. Hence, $\boldsymbol{G, and\ \delta}$ are summarised as the individual's current health status. The individuals labour supply equation considered in this study is thus:

$$\boldsymbol{Lp = T - TL^{*} - T_h^{*} = Lp\,(W,\ Mal\,, Z\,)} \qquad (4.11)$$

Where the choice to participate or be employed in the labour force ($\boldsymbol{Lp}$) depends on wage (W); measured using per capita income expenditure; health status (MAL); measured using response to been ill with malaria, observable factors (Z); measured using educational attainment, gender, place of residence, marital status and other control variables such as age and living with young children[26].

4.3 Empirical Model for Labour Employment Probability (objective 1)

For the purpose of estimation, empirical specification of labour employment equation used in the study is presented as:

$$\boldsymbol{Lp_i} = \alpha_0 + \alpha_1\, \boldsymbol{MAL_i} + \alpha_2\, \boldsymbol{INC_i} + \alpha_3\, \boldsymbol{EDU_i} + \alpha_4\, \boldsymbol{GEN_i} + \alpha_5\, \boldsymbol{AGE_i} + \alpha_6\, \boldsymbol{AGE_i^2} + \alpha_7\, \boldsymbol{MAR_i} + \alpha_8\, \boldsymbol{RES_i} + \alpha_9\, \boldsymbol{KIDS_i} + \boldsymbol{\varepsilon_i} \qquad (4.12)$$

Where: $\boldsymbol{Lpi}$ represents the probability of participating in the labour market which assumes the value of 1 for employed individuals and 0 for unemployed persons. This follows the intuition that an individual who supplies non-zero work hours or workdays in the labour force is employed and participates in the labour market and zero work hours or workdays supplied implies non- participation.

[26] See for instance Smith, (1981); Bridges and Lawson, (2008); Aminu, (2010); Contreras, (2010); Fadayomi and Ogunrinola, (2011); Machio, (2012)

MALi is reported health status of persons ill with malaria measured using response to whether the individual had malaria or was healthy two weeks prior to the HNLSS. INC signifies labour income initially represented by W. The observable factors Z are captured by EDU, GEN, AGE, AGE^2, MAR, RES and KIDS. EDU represents educational attainment considered as a categorical variable in primary, secondary, tertiary and no education. GEN implies gender, grouped into male and female categories, AGE and AGE^2 capture the effect of age and aging respectively on labour force participation; MAR[27] implies marital status, RES denotes place of residence whether urban or rural and KIDS indicate living with young children ages 0 to 4 years and 5 to 8 years; $\boldsymbol{\varepsilon}$ represents a randomly distributed error term with zero mean and constant variance.

Drawing from the theoretical background of this study, it is expected a priori that $\propto_1$ <0. This is based on the notion that the onset of illness initiates poor health status and implies a fall in an individual's health capital stock. The fall in health capital stock increases the time spent to seek good health resulting in a rise in time lost from engaging in market activities. The substitution and income effects associated with labour income imply ambiguous effects of the latter on labour force participation hence, $\propto_2 > \mathbf{0}$ as income increases but for relatively large increase in income, $\propto_2$<0. Higher educational attainment is expected to have positive effect on labour participation. This is in connection with efficiency and work ethics associated with education. These features motivate demand for educated persons in the workforce. However, such abilities are needed basically in formal work types. Generally, it is expected that $\propto_3$>0 (Bridges and Lawson, 2008; Machio, 2012). Societal demand on males for financial support implies that $\propto_4$ is expected to be positive when gender is captured by male with female as the reference category (Machio, 2012). Individuals within the age bracket of the economically active population are expected to participate in the labour force. This suggests that a priori $\propto_5$ >0. It is expected that employment probability in the labour force falls as individual's age beyond the economically active population age bracket. This is because ageing induces body weakness and makes individuals less active. This implies that a priori $\propto_6 < \mathbf{0}$.The effect of marital status $\propto_7$ on the probability of participating in the labour force is

[27] Marital status was dropped during the analysis due to high collinearity. The empirical model for labour force participation was analysed without marital status as an explanatory variable

expected to have ambiguous signs. This is because married people could supply more labour hours to earn more income in order to meet family financial demands or supply less labour hours due to family commitment requiring more time at home, especially for the females. Thus, $\mathbf{0} < \propto_7 < 0$ (Machio, 2012; Bridges and Lawson, 2008). It is expected that $\propto_8 > 0$ for persons living in the urban areas. This is because industrialisation that characterise urban settlements increase chances of gainful employment relative to rural areas. It is also expected that $\propto_9 < \mathbf{0}$ for living with children aged 0 to 4 years and $\propto_9 > \mathbf{0}$ for living with children 5 to 9 years. The expected sign for living with young children applies mainly to females who are generally required to provide care and nurture young children. Having children is expected to raise labour participation for males due to increased financial demand (Aminu, 2010; Swaminathan and Lillard, 2000).

The variables in equation 4.12 are further described in Table 4.1. The table shows variable symbols as used during the analysis.

Table 4.1 Variable Description

Variable	Description
Malaria (malaria_2wks)	Binary response variable capturing health status where 1 represents persons who had malaria two weeks prior to the survey and 0 persons who are healthy

Income (Logincome)	Continuous variable representing natural logarithmic value of per capita household income
Place of Residence (Urban)	Dummy variable capturing individuals who live in the urban areas
Gender (Gend_male)	Dummy variable capturing gender; male=1 and female=0
Age (Age) Years	Continuous variable representing individuals aged 15-64
Square of Age (Agesquared) Years-squared	Continuous variable capturing the effect of ageing in the sample
(Education) Prim_Educ	Dummy variable indicating persons with primary education
(Education) Sec_Educ	Dummy variable for persons with secondary education
(Education) Tert_Educ	Dummy variable representing persons with tertiary education
(Education) No_Educ	Dummy variable for persons with no form of formal education
Young Children (kids0004)	Individuals from households with children aged 0-4 years
Young Children (kids0509)	Individuals from households with children aged 5-9 years

Source: Author's computation

4.4 Estimating Cost of Illness

From equation 4.10 it can be deduced that the onset of illness induces reduction in total workdays and results in productivity loss. Workdays lost in this case is applicable to persons who have malaria and are gainfully employed. The equation suggests that estimates of workdays lost is required to determine productivity loss from illness particularly when using methods of estimating indirect costs such as the HCA.

In addition, the inclusion of the health variable in the utility function suggests that individuals derive satisfaction from being healthy. Hence, persons who are ill seek

measures to restore their health status. Individuals incur health costs for treatment of an illness and also take time off work to recuperate An individual who falls ill consequently incurs healthcare costs otherwise referred to as direct costs of illness (Alaba and Alaba, 2009; Mclinden, 2013; Zhang *et al* 2013). This study examines direct costs components due to malaria as the sum of four basic components; transport costs to the hospital, physician consultation charges, cost of drug and hospitalisation costs (Mclinden, 2013; Zhang *et al* 2013).

4.4.1 Empirical Estimation of Indirect Costs for a Bout of Malaria (Objective 2)

Following the argument that there is productivity loss associated with illness, this study computes indirect cost associated with an episode of malaria using specifications of the HCA presented as

$$\boldsymbol{IDC_i = NMD_i * DE_i} \quad (4.13)$$

Where: $\boldsymbol{IDCi}$ represents mean indirect costs, NMD$\boldsymbol{i}$, represents the number of missed work days[28], and DE$\boldsymbol{i}$ is daily earnings for an individual $\boldsymbol{i}$ (Koopmanschap and Rutten, 1996; Joel and Segel, 2006; Alaba and Alaba, 2009; Ghatak *et al* 2011; Salihu and Sanni, 2013; Mclinden, 2013). Equation 4.15 is estimated only for persons with malaria who are gainfully employed. Earnings of such persons and missed work days are used to compute average figures for productivity loss due to a bout of malaria. Thus individuals with malaria who did not miss any workday were not included in the sample used to determine productivity loss from malaria.

4.4.2 Empirical Estimation of Direct Cost for a Bout of Malaria (objective 3)

For the purpose of computation, direct cost associated with a bout of malaria is determined using the BUA[29] given as:

$$\boldsymbol{DC_i = \sum_j^4 TEM} \quad (4.14)$$

Where: $\boldsymbol{DCi}$ represents average direct cost associated with treatment of a bout of malaria for an individual $\boldsymbol{i}$, TEM, represents total expenditure for the treatment of malaria. Total expenditure for treating malaria is determined as a summation of four

[28] [28] This study examines mean workdays lost for a one month period.
[29] The BUA has been explained in chapter 3.

cost types incurred by individuals during treatment. Based on available data, components of direct costs considered are transport costs to the hospital, physician consultation charges, cost of drug and hospitalisation expenditure.

To further determine cost burden for treatment of an episode of malaria, the study measures the proportion of monthly income expended on a bout of malaria as:

$$\boldsymbol{MF_i} = \left(\frac{\boldsymbol{DCi}}{\boldsymbol{MInci}} * \mathbf{100}\right)\% \quad (4.15)$$

Where: $\boldsymbol{MF_i}$ characterise average percentage value of monthly income for an individual $\boldsymbol{i}$ spent on malaria treatment. $\boldsymbol{DCi}$ represents average value of total costs incurred during treatment of one bout of malaria and $\boldsymbol{MInci}$ symbolises the average monthly income for an individual $\boldsymbol{i}$ in the sample.

4.4.3 Empirical Estimation of Total cost (for an episode of malaria) as a fraction of GDP (objective 4)

This study estimates the fraction of GDP lost to an episode of malaria using total cost associated with a bout of the illness as a percentage of GDP[30]. For simplicity, the study computes total direct and indirect costs in relation to the illness assuming every individual of all age groups in Nigeria experiences one bout of malaria per year. This follows from postulations that about half of the adult population in Nigeria experience at least one episode of malaria per year with children under-five years of age having as much as 2 to 4 bouts (FMOH, 2005; UNICEF, 2010).

To achieve this objective, the study computes total costs in relation to Malaria; first, by multiplying mean direct costs with total population size for the entire Nigerian populace[31]. This is to obtain total direct costs of all persons in the population. Total direct cost for all persons in the population is determined as:

$$\boldsymbol{TDC} = \boldsymbol{DCi} * \boldsymbol{Pop} \quad (4.16)$$

[30]Figures for 2009 nominal GDP were used in conformity with the period for which the HNLSS was conducted

[31] National population figures used in the analysis were also obtained using estimates for 2009.

Where; $\boldsymbol{TDC}$ represents total direct cost for all persons in the population, $\boldsymbol{DCi}$ symbolises direct cost per individual as obtained in equation 4.13 and Pop represents population size.

Second, the study computes indirect costs only for the fraction of individuals in the economically active population who missed workdays due to Malaria. Fraction of persons in the working population who missed workdays is determined by the fraction of individuals in the study sample who missed workdays due to malaria. The study hence computes total indirect costs associated with malaria in three stages; stage 1 indicates determination of number of persons in the economically active population, stage 2 shows computation of proportion of persons in the economically active population who missed work days due to Malaria and stage 3 shows computation of indirect costs for persons who missed workdays while ill with malaria.

First stage:

$$\boldsymbol{EA = X * Pop} \tag{4.17}$$

Where: EA characterised the fraction of economically active population in the total population and X represents the percentage of the economically active population in the total sample surveyed in the HNLSS.

Second stage:

$$\boldsymbol{EAM = M * EA} \tag{4.18}$$

Where: EAM symbolises persons in the economically active population who missed workdays due to malaria, M denotes percentage of the economically active respondents who missed workdays from malaria as obtained in the study sample.

Third Stage

$$\boldsymbol{TIDC = IDC_i * EAM} \tag{4.19}$$

Where: TIDC implies total indirect cost for an episode of malaria in Nigeria, $\boldsymbol{IDC_i}$ is defined already as indirect cost for each individual and EAM is as earlier defined.

Total cost associated with an episode of malaria in Nigeria (TC) is hence estimated as the sum of total direct costs and total indirect costs;

$$\boldsymbol{TC = TDC + TIDC} \tag{4.20}$$

Total cost associated with malaria as a fraction of GDP is hence estimated as

$$\boldsymbol{GDP_{lost}} = \left(\frac{\boldsymbol{TC}}{\boldsymbol{GDP}} * \mathbf{100}\right)\% \tag{4.21}$$

4.5 Analytical Technique

4.5.1 Estimation Technique for Labour Employment Probability.

The study employs the use of instruments in analysing malaria effect on labour force participation based on suspected endogeneity between health and labour participation decisions. The study therefore made use of instrumental variable probit model and adopted the ML estimation technique. (Stern, 1989; Cai and Kalb, 2004; Machio, 2012). Only instruments relevant in explaining malaria were included at each level of analysis. (Cai and Kalb, 2004; Cai 2007). The distances to the nearest health facility and nearest food market were used as instrumental variables[32]. Endogeneity test result for malaria and labour force participation was determined using Wald chi-2 statistic and test for over identification restrictions was conducted using the Amemiya-Lee Newey minimum chi-square tests[33]. The analytical procedure was done using Stata version 11.

4.5.2 Estimation Technique for Cost Burden

Computations for direct and indirect costs were determined using cross tabulations and summary statistics. This enabled examination of level of statistical significance of cost figures using T-values derived from mean coefficient and the associated standard

[32] See Stern 1989, Bridges and Lawson, 2008; Cai *et al* 2010; Machio, 2012, for further application of instrumental variable models relating health and labour force participation.

[33] The ML estimation by default provides the Amemiya test statistics for over identification restrictions. The Amemiya test statistics for over identification restrictions are obtained as byproducts of Amemiya's generalised least square procedure in simultaneous equation models with limited dependent variables (Lee 1991).

error[34]. The study made use of stata version 11 and Microsoft excel package for computation of mean cost figures.

4.6 Levels of Analysis

The study objectives are examined at six levels; national, employment types, place of residence, gender, income group[35] and geopolitical zones. Employment types are firstly grouped into formal and informal employment[36] and further into self-employment in agriculture, other self-employment types (owned account)[37] and wage employment[38].

4.7 Data Source

Data used for the study was from the HNLSS produced by the NBS (2010). The HNLSS is the latest in a series of poverty survey instruments developed by the NBS. It combines the two distinct components of poverty survey instruments developed by NBS. These are the Core Welfare Indicator Questionnaire (CWIQ) referred to as the HNLSS Part A and the Nigerian Living Standard survey (NLSS) otherwise known as the HNLSS Part B. The HNLSS Part A, was designed to provide data for socioeconomic indicators such as health, education, employment, intra-country migration, housing, ownership of durable assets, crime and security, poverty and household consumption expenditure. The HNLSS part A, extended the CWIQ with the introduction of new sections such as water and sanitation, malaria and gender-based

[34] Gujarati D.N. (2004) in pages 134 and 135 explicitly shows derivation of T-statistics using parameter figure and the associated standard error

[35] Income groupings were in poor and non-poor categories. Individuals were grouped as poor and non-poor using the subjective poverty measure. Choice of this measure is based on the fact that it apparently better captures poverty incidence in Nigeria relative to other measures presented in the HNLSS. Using the HNLSS benchmark figure of N56992.77 for absolute poverty gives incredibly 6% of poverty incidence in Nigeria.

[36] This study defines persons in formal sector employment as employees in the government sector, non-governmental organisations, and international corporative / diplomatic mission. Persons in informal employment type are those in self- agricultural employment, local cooperatives, private sector apprentices, unpaid family businesses, paid household employees and all self-employment types.

[37] Owned account employees refer to persons in informal business enterprises (e.g. shop keepers and traders), dress makers, barbers, carpenters and taxi drivers.

[38] Wage employment individuals are grouped as persons in formal employment type, local cooperatives, employees, paid household chores and other forms of paid informal employment.

violence (NBS, 2010). This study made use of the HNLSS Part A which was a follow up of the CWIQ[39].The survey was carried out over a period of 12 months.

The sampling frame used in the HNLSS Part A, comprised 774 LGA's. The HNLSS sample frame was constructed into replicates such that each LGA has three replicates. In each replicate were ten Enumeration areas (EAs) serially numbered 01 to 10. Prior to the main survey was a complete listing of all housing units and households in each EA. The survey adopted a two stage sampling technique in which the selection of EAs represented the first stage or primary sampling unit (PSU) while the selection of households formed the second stage or secondary sampling unit. Ten EAs were selected in each LGA with ten households systematically selected in each enumeration area. This produced a total of 100 households per LGA and 77,400 households nationally. The survey covered a total of 332,937 individuals. It also covered the six geopolitical zones with 100% response rate except the south west which had the least response rate of 99.9%.

General population distribution revealed that the survey comprised 50.62% males and 49.38% females. Information on age distribution showed that the population comprised more of those in the working age. Persons aged 0 to14 years accounted for 38.92% of the population. Individuals aged 15 to 64years (economically active population) comprised 56.61% of the populace and those aged 65 to 70 years made up 4.47%. Sector distribution of persons shows that the Nigerian population is predominantly made up of rural dwellers (74.88%). Urban residents made up 25.12% of the population. In terms of education, individuals were asked to state their highest form of educational attainment. The survey revealed that the Nigerian population has more individuals with secondary school educational attainment (32.44%) and persons with no educational attainment (31.12%) relative to individuals with primary education (26.70%) and those with tertiary education (9.74%).

Data collected on health provides information on the health condition of the individual two weeks before the interview date. Respondents were asked to identify type of illness experienced most frequently two weeks prior to the survey, who diagnosed the ailment, number of days for which usual activities were halted due to illness, amount spent on medication, consultation, hospital admissions, and transport to the hospital.

[39] At the time this study was conducted, results for HNLSS part B were not yet available.

For all age groups the HNLSS had an overall of 332,937 individuals. A total of 24,849 (7.46%) individuals reported one form of the 21 illness types recorded during the survey. Persons who had malaria accounted for 3.07% (10,221). A total of 188, 497 were in the economically active population, persons in the work force reporting illness were 16,882, those reporting only malaria were 5,116 (30.30%). This study made use of persons in the economically active population who had malaria and those who did not report any form of illness during the two weeks recall period. This is to avoid overshadow effect of other illness on participation decisions.

Data on labour market outcome were diverse; on employment decisions, respondents were asked to state number of weeks out of work if not employed seven days prior to the survey. Persons employed where asked to state work type where most time was spent in 12 months prior to the survey. Employment distribution of persons in the economically active population in Nigeria indicates more participation in informal sector employment (92.19%) than formal sector employment (7.09%). Individuals engaged in agricultural self-employment constituted 43.29% while those in other forms of self-employment (owned account) comprised 49.02%, Persons in wage employment (formal and informal) were 7.68% of the population.

CHAPTER FIVE

SAMPLE DISTRIBUTION, RESULTS AND DISCUSSION

5.1 Introduction

This chapter provides information on the distribution and descriptive statistics of variables used in the study. Diagnostic tests, estimates of probit regression analysis, workdays lost and costs associated with malaria are also presented in this section.

5.2 Distribution of Persons in the Economically Active Population who had Malaria

The distribution of persons in the economically active population who had malaria two weeks prior to the HNLSS is presented in Table 5.1. The reported figures show higher incidence of malaria among rural than urban dwellers. About 72.56% of reported cases of malaria were from the rural areas while urban constituted only 27.44%. This result can be attributed to the vast vegetation and farmland that characterise rural areas. Such vegetation can create breeding sites for mosquitoes and hence, increase rural dwellers vulnerability to malaria parasites. In terms of gender, reported cases of malaria are higher among females (57.49%) than males (42.51%).

An examination of individuals reporting malaria across income groups, show more cases of the illness among poor persons (51.06%) than those who are non-poor (48.94%).The small difference in reporting malaria among poor and non-poor persons gives inkling to vulnerability of individuals to the illness regardless of income status.

Table 5.1 Distribution of Persons with Malaria in the Economically Active Population

Levels	Number	%
	Place of Residence	
Rural	3,712.00	72.56
Urban	1,404.00	27.44
	Gender	
Male	2,175.00	42.51
Female	2,941.00	57.49
	Income groups	
Poor	2,612.23	51.06
Non Poor	2,503.77	48.94
	Employment type	
Informal	4,090.00	93.39
Formal	387.00	7.61
Informal/Formal		
Wage	364.00	8.22
Informal		
Self-Agric	2,159.00	48.77
Self-Others(owned account)	1,904.00	43.01
	Geopolitical zone	
North-Central	414.00	8.09
North-East	474.00	9.27
North-West	1,156.00	22.60
South-East	934.00	18.26
South–South	1,256.00	24.55
South-West	882.00	17.24

Source: Author's computation from HNLSS.

Reported cases of malaria across employment types[40] show higher incidence of the illness for individuals in the informal sector (93.39%) than the formal sector (7.61%).

[40] The figures for employed persons in the economically active population does not sum up to 5116 which represents total number of persons in the economically active population with malaria. This is explained by the fact that some persons in the economically active population were unemployed during the period of the HNLSS.

This occurrence can be associated with the fact that persons in the informal sector, work into late evenings and also engage in working environments not protected from exposure to mosquito bites. This increases their vulnerability to the illness. Further examination of employment types shows more reported cases of malaria among persons in agricultural self-employment (48.77%) than those in other forms of self-employment (43.01%). Reported cases of malaria are lowest among wage workers (8.22%). The distribution of malaria cases for self-employed workers can be explained by vulnerable environment for which informal work types are executed. Higher susceptibility of agricultural workers to malaria relates with carrying out economic activities in vegetation lands that are commonly infested with mosquitoes.

Distribution of persons with malaria across geopolitical zones shows highest proportion of individuals with the illness in the South-South part of the country. Approximately 24.55% of South-South dwellers reported malaria. This is followed by individuals who live in the North-West (22.60%), South-East (18.26%), South-West (17.24%), North-East 9.27%, and North-Central (8.07%). Persons in the North-East and North-Central had the lowest cases of malaria. Overall, southern dwellers recorded more cases of malaria than persons who reside in the north.

5.3 Distribution of Persons in the Study Sample (Individuals with malaria and those who are healthy)

The employment section of the HNLSS required individuals to state number of weeks' out-of-work seven days prior to the survey. This study categorised persons who indicated not- out-of-work in the seven days prior to the survey as gainfully employed and those who were out-of-work as unemployed. Figures for employment distribution of persons as used in the study sample are presented in Table 5.2.

Table 5.2 Percentage Distribution of Employed and Unemployed Individuals Disaggregated by Sector, Gender and Educational Attainment

	Unemployed	Employed	% in total population
All	48,178 (27.60)	126,381(72.40)	100
		Place of Residence	
Rural	36,053 (28.10)	92,256 (71.90)	73.54

Urban	12,125 (26.23)	34,125 (73.77)	26.46
		Gender	
Male	23,193 (26.94)	63,032 (73.06)	49.47
Female	24,985 (28.29)	63,349 (71.72)	50.53
		Education	
No Education	2,686 (27.94)	6,975 (72.07)	9.63
Primary Education	8,220 (26.99)	22,380 (73.01)	30.57
Secondary Education	15,399 (33.42)	30,777 (66.59)	46.23
Tertiary Education	3,381 (24.71)	10,257 (75.20)	13.57

Source: Author's computation from HNLSS.
Note: Figures in bracket represent corresponding percentage value.

Distribution of persons in the study sample in terms of employment status reveals about 126,381 (72.40%) as gainfully employed. Unemployed persons were approximately 48,178 (27.60%).

The proportion of unemployed persons in the study sample is slightly lower in the urban (26.23%) than rural areas (28.10%). The implication is higher percentage of

employed persons in the urban (73.77%) than rural areas (71.90%). This outcome can be attributed to high employment opportunities that characterise urban centres.

Employment distribution of persons across gender shows that employed persons have a slightly higher share of males (73.06) than females (71.72). This is expected because women commonly engage in non-economic activities particularly home upkeep and nurturing of children.

An examination of employment status across levels of educational attainment shows that individuals with secondary education have the highest proportion of unemployed persons (33.42%) followed by those with tertiary (24.71%), primary (26.99%) and no-education (27.94%). The higher proportion of unemployed persons with secondary school qualification can be as result of high composition of persons with secondary education in the Nigerian workforce. This reduces their chance of gainful employment because available jobs for such persons will be highly competitive. The figures showed that there were about 46.23% of individuals with secondary education. This is followed by those with primary education (30.57%), tertiary (13.57%) and no-education (9.63%).

The distribution of only employed persons as used in the study is shown in Table 5.3. The figures in the table show that a vast majority of employed individuals are in the informal sector (92.91%). Those in formal work types are about 7.09%. In terms of informal employment types, most individuals are commonly in owned account activities than any other employment type.

Table 5.3 Employment Distribution of Respondents by Gender, Sector and Educational Attainment

	Informal	Formal	Wage	Self-employment agriculture	Other self-employment (owned account)
All	132,293	10,138	10,896	61,786	63,659 (49.91)

	(92.88)	(7.12)	(7.71)	(43.38)	
			Gender		
Male	67,337 (50.90)	6,326 (62.40)	6,725 (61.21)	39,101 (63.29)	27,837 (39.96)
Female	64,956 (48.86)	3,812 (37.60)	4,261 (38.79)	22,685 (36.72)	41,822 (60.04)
			Place of Residence		
Rural	102,804 (77.91)	5,571 (54.95)	6,176 (56.22)	55,088 (89.16)	47,111 (67.63)
Urban	29,489 (22.29)	4.567 (45.05)	4,810 (43.78)	6,698 (10.84)	22,548 (32.37)
			Education		
No Education	8,013 (10.85)	288 (2.63)	270 (2.91)	3,973 (13.38)	3,998 (9.18)
Primary Education	25,768 (34.89)	903 (10.41)	1,059 (11.42)	11,893 (40.04)	13,719 (31.50)
Secondary Education	33,581 (45.47)	2,577 (29.71)	2,849 (30.70)	11,663 (39.26)	21,648 (49.71)
Tertiary Education	6,487 (8.79)	4,967 (57.26)	5,097 (54.97)	2,175 (7.32)	4,182 (9.60)

Source: Author's computation from HNLSS.
Note: Figures in brackets represent corresponding percentage value

The proportion of males engaged in formal employment (62.40%) is slightly higher than in informal employment type (50.90%). On the other hand, female engagement in employment activities is higher in informal sector employment (48.86%) than formal

employment type (37.60%). Male participation in employment activities is higher than females for all employment types except for owned account. Approximately 60% of individuals engaged in owned account are females. Male participation exceeds that of females in wage and self-employment in agriculture but lower than females in owned account employment. Women's high involvement in owned account can be linked to concurrent work function of this employment type with performance of household chores.

Individuals who reside in the rural areas are also found to be engaged more in informal employment (77.91%) than in formal employment (54.95%). This contrasts with urban dwellers who are more engaged in formal sector employment (45.05%) than informal employment (22.29%). Rural dwellers practise more of self-agricultural activity (89.16%) than other self-employment (67.63%) and wage work (56.22%). On the other hand individuals in the urban areas are more engaged in wage employment activity (43.78%) than self-employment in agriculture (10.84%) and other self- employment (32.37%).

In terms of educational attainment, individuals in informal sector employment are mostly persons with secondary (46%) and primary education (35%). Individuals with no formal education (11%) are also likely to be engaged in informal employment activities than in formal employment activity (3%). Persons who have tertiary education are more in formal sector employment (57%) than in informal employment type (9%). Persons with no formal education and primary educational attainment are mostly engaged in self-agricultural employment activities (13% and 40% respectively) than other employment types. While those with secondary school attainment are mostly employed in owned account (50%) relative to self-agriculture (39%) and wage employment (31%). Individuals with tertiary educational attainment are commonly found in wage employment type (55%) than self- employment in agriculture (7%) and owned account (10%).

5.4 Descriptive Statistics of Variables

The descriptive statistics of variables used in this study are presented in Table 5.4. Descriptive results for labour employment comprised those healthy and those who have malaria. The health variable (malaria), employment in the labour force, place of residence, gender, educational attainment, employment types, poor and non-poor groups of persons and geopolitical zone are treated as binary variables. All other variables used in the study such as income, age, age squared, number of children, distance to nearest health centre, distance to nearest food market, expenditure on malaria treatment such as transportation, consultation, hospitalisation, drug and medical supplies are continuous variables.

Table 5.4 Summary Statistics and Percentage Composition of Variables

Variable	Mean	Standard Deviation	Minimum	Maximum	Observation No (%)
Malaria_2wks	0.028	0.166	0	1	5116 (3%)
LFP_7days (employed=1)	0.724	0.447	0	1	126,381 (72.40%)
Informal_Employment	0.929	0.257	0	1	132,293 (92.88%)
Formal_Employment	0.071	0.257	0	1	10,138 (7.12%)
Wage_Employment	0.077	0.267	0	1	10,986 (7.71%)
Self-employment in Agriculture	0.434	0.496	0	1	61,786 (43.38%)
Other Self-employment (Owned_accoount)	0.489	0.500	0	1	69,659 (48.91%)
Poor	0.46	0.50	0	1	81,820 (46.19%)
Non-poor	0.54	0.50	0	1	95,331 (53.81%)
Urban	0.265	0.441	0	1	47,545 (26.46%)
Rural	0.735	0.441	0	1	132,142 (73.54%)
Gend_Male	0.494	0.500	0	1	88,774 (49.40%)
Gend_Female	0.506	0.500	0	1	90,913 (50.60%)
No_Educ	0.097	0.296	0	1	9,957 (9.71%)
Prim_Educ	0.306	0.461	0	1	31,414 (30.64%
Sec_Educ	0.460	0.498	0	1	47,209 (46.05%)
Tert_Educ	0.136	0.343	0	1	13,946 (13.60%)
Age (years)	32.585	13.142	15	64	179687 (100%)
Age-Squared (years^2)	1234.520	962.065	225	4,096	179687(100%)
Log-income (₦)	10.750	0.945	7.383	21.795	26, 855 (1.50%)

kids0004 (number, years)	0.739	0.940	0	4	26,823 (n/a)
kids0509 (number, years)	0.587	0.839	0	8	26,855 (n/a)
Distance Foodmkt (km)	2.818	1.463	1	6	17,6503 (n/a)
Distance health centre (km)	3.021	1.513	1	6	17,5737 (n/a)
Components of Direct cost					
Consultation costs (₦)	810.428	178.714	0	30,000	5,116 n/a
Transportation costs (₦)	466.545	878.064	0	5,000	5,116 n/a
Hospitalisation costs (₦)	530.000	3953.962	0	80,000	5,116 n/a
Drug and medical supplies costs (₦)	920.461	2,566.048	0	70,000	5,116 n/a
Geo-political Zone					
North-Central	0.167	0.373	0	1	29,980 (16.68%)
North-East	0.157	0.364	0	1	28,183 (15.68%)
North-West	0.261	0.439	0	1	46,936 (26.12%)
South-East	0.117	0.322	0	1	21,069 (11.73%)
South-South	0.150	0.357	0	1	26,988 (15.02%)
South-West	0.148	0.355	0	1	26,531 (14.77%)

Source: Author's computation from HNLSS

Notes:

1. Labour force participation sample compared those ill with malaria with those healthy.
2. Cost computation was for only persons with malaria (5116 individuals).
3. n/a means not applicable.

As shown in Table 5.4, approximately 3% of the economically active population responded positively to have had malaria in two weeks. The remainder of 97% did not have any form of illness during this period. The small percentage figure of persons who had malaria can be attributed to the short period the respondents were asked to indicate whether they had malaria or not.

The figures also show that about 72% of individuals were gainfully employed in the study. Persons who were unemployed made up approximately 28% of the sample. More than 90% of employed persons used in the study were in the informal sector. Formal sector workers used in the analysis comprised about 7% of the employed workforce. This result does not diverge from expectation given that the Nigerian economy as is the case with developing economies is highly informal in nature. Individuals in wage employment included in the study, whether formal or informal wage employment were quite few. This group of persons made up only about 8% of employed individuals. A large fraction of the workforce used in the study engages in self-employed activities. Approximately 43% of the workers were in self-agricultural employment and about 49% in other self-employment types. These two made up over 90% of total employments figures.

The table further showed that persons who were poor in the study sample were about 43.19% compared to the non-poor (53.81%). The higher proportion of the non-poor relative to poor persons can be linked to the inclusion of healthy persons along with those who reported malaria illness. It is likely that non-poor persons were in the group of healthy individuals. This follows from earlier sample distribution of poor and non-poor persons reporting malaria (Table 5.1). Individuals who were healthy made up more than 90% of the study sample.

The table also reaffirms the predominantly rural nature of the Nigerian economy with rural percentage composition of 73% and urban 27%. Male to female composition were approximately equal. Each gender had about 50% composition.

Figures for educational attainment show that more individuals in the economically active population were secondary school leavers. Individuals with secondary educational attainment constituted about 46% of the workforce, followed by those with

primary (31%) and tertiary education (13%). Approximately 10% of the workforce used in the study had no formal education. Overall, a large proportion of the workforce in the study sample had received some form of formal education.

Mean age for persons in the economically active population was about 33 years. This is an indication that on the average persons in the workforce included in the study sample were about 33 years of age. The standard deviation for age of about 13 years shows that values for age across individuals were about 13 years around the mean age value. The mean income value of 10.75% and small standard deviation of 0.94% show a less than 1% spread of individual income around the mean value.

As shown in the table, mean value for persons with young children 0 to 4 years is higher (74%) relative to those with children 5 to 9 years (59%). This shows that the sample comprised more persons with young children whose age were 4 years and below than those with children aged 5 to 9 years.

The table shows that mean figure for the distance to food market is slightly lower (2.82 km) than mean figure for distance to health facility (3.02km). This figure is as expected in line with the intuition that it is much easier to set up a food market than to put up a health facility. And in most cases health facilities are situated in commercial centres which may be far from place of residence while food markets are commonly close to residential areas. The latter requires special expertise and more funds.

Mean figures for direct cost components reveal that individuals spend more on the average for purchase of drug and medical supply than other forms of cost incurred for malaria treatment. Average values for geopolitical zone in the country indicate that the study sample had more persons in the North-West (26%), than any other zone in the country. This is followed by the North-Central (17%), the North-East (16%), South-South (15%), South-West (15%) and the South-East zone (12%). The South-East zone had the smallest population fraction in the study.

5.5 Diagnostic Test Results on Validity of Instruments

Diagnostic test results for relevance of instruments used in the study are presented in Tables 5.5a, 5.5b and 5.5c. The result enables determination of instruments relevant in explaining malaria incidence. The analysis was presented in six levels. These are at the

national level, across employment types, place of residence, gender, income groups and geopolitical zone. The reported p-value enables an examination of the statistical significance of instruments in explaining the health variable (malaria). The Chi-square test[41] for significance of instruments allows for strength of the instrument while test for over identification restriction[42] help determine whether the instruments are correlated with the structural error term. Suitable instruments were those relevant based on statistical significance and valid over identification restrictions. Only instruments that are statistically significant and show valid over identification restrictions are considered relevant in explaining malaria incidence.

5.5.1 Diagnostic Test Results on Validity of Instruments across Employment types

The test of instrument validity for the different employment types are shown in Table 5.5a. The figures reported were for national, informal and formal employments. The results were further presented for wage, self-employment in agriculture and other self-employment types. Each level of analysis presented in the table was examined based on relevance of instruments used in the study.

[41] Joint chi2 test were reported where both instruments are statistically significant otherwise. Otherwise reported chi2 test was for only the instrument that is statistically significant. Chi square value for statistical significance of instrument was derived from first stage regression with malaria as the dependent variable.

[42] Test results for over identification were extracted from the two stage instrumental variable probit regression using only the instrument that is statistically significant with labour force participation as the dependent variable

Table 5.5a Relevance of Instruments (Employment types)

Variable/ Level	National	Informal	Formal	Formal/Informal	Informal (Self Employment)	
				Wage Employment	Agricultural employment	Other self-employment (Owned account)
Dist_Food	0.005 (3.56)***	0.006 (4.23)***	-0.001 (-0.19)	-0.001 (-0.27)	0.006 (3.24)***	0.0066 (2.73)***
Dist_health	0.003 (2.36)**	0.002 (1.41)	0.005 (1.72)*	0.0054(1.82)*	0.003 (2.02)**	-0.0011 (-0.46)
Chi2 test for H_0: Coefficient on instrument (s)=0 (p-value in bracket)	35.40 (0.0000)	17.93 (0.0000)	2.96 (0.0852)	3.33 (0.0680)	27.68 (0.000)	7.45 (0.0063)
Amemiya-Lee-Newey minimum chi-sq statistic of Overidentification restrictions(H_0: Overidentification restirictions are valid	0.987 (0.3204)	0.00(.)	0.00(.)	0.00(.)	2.301 (0.7293)	0.00 (.)

Source: Author's computation

Notes:

1. Marginal effects of coefficients are reported with Z-values in brackets.
2. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels respectively.
3. (.) Represents exactly identified equations

An examination of the test of relevance of instruments in terms of statistical significance shows that the distance to the nearest food market and health centre are statistically significant at national level. However, the informal and formal dichotomy reveals the distance to the nearest food market as statistically significant for informal employment type. Distance to the nearest health centre is the statistically significant in formal employment. Wage employment showed distance to the nearest health facility as statistically significant in explaining malaria while the distance to the nearest food market and health centre are statistically significant in self-employment in agriculture. Other self- employment showed distance to the nearest food market as the statistically significant instrument.

The chi-square test result showed that the statistically significant instrument (s) had none zero coefficient at 1% level for all employment types except formal and wage employment. The statistically significant instruments in formal and wage employment had none zero coefficient at 10% significance level.

The chi-square test result for strength of instruments was above the rule of thumb threshold of 10. Chi-square statistics above the threshold value of 10 suggests that the instruments are not weak in explaining the variable instrumented for (Bound *et al* 1995). The only exception where the strength of instruments was below the threshold value was for formal, wage and other self-employment. However, the instruments were shown to be statistically significant in explaining the potentially endogenous variable across all levels of analysis in the table. This is an indication that instruments used in the study were strong and relevant except for formal, wage and other self-employment where they were relevant but weak in explaining malaria prevalence.

Test for over-identification restriction was shown to be valid across all employment types. However, test results were exactly identified for informal, formal, wage and other self-employment groupings. The equations that were exactly identified reflected the use of only one statistically significant instrument in computation of the identification restriction test. The test result for over-identification restrictions hence shows that the statistically significant instrument(s) was/were not correlated with the structural error term. The implication therefore is that the choice of instrument(s) used

in the different categories of the analysis adequately capture malaria incidence in the respective groups.

5.5.2 Diagnostic Test Results on Validity of Instruments across Place of Residence, Gender and Income groups

Results for the validity of instruments across place of residence, gender and income categories are presented in Table 5.5b. Estimates for place of residence are shown separately for urban and rural areas while that for gender is for male and female categories. Income groups on the other hand were examined along poor and non-poor dichotomy.

The test for relevance of instruments in terms of statistical significance shows the distance to the nearest health centre as statistically significant at the urban level, for females and non-poor individuals. Distances to the nearest food market and health centre were statistically significant for rural dwellers. Distance to the nearest food market was also statistically significant in explaining malaria for males and persons who are poor.

Table 5.5b Relevance of Instruments (Place of Residence, Gender and Income Groups)

	Place of residence		**Gender**		**Income groups**	
Variable	Urban	Rural	Male	Female	Poor	Non poor
Dist_Food	-0.002 (-0.92)	0.005 (3.4)***	0.004 (3.18)***	0.006 (1.09)	0.003 (1.74)*	0.0003 (0.59)
Dist_health	0.020 (7.44)***	0.024 (11.66)***	0.000 (0.1)	0.025 (4.73)***	-0.0003 (-0.19)	0.0001 (1.73)*
Joint Chi2 test for H_0: Coefficient on instrument (s)=0 (p-value in bracket)	3.38 (0.0658)	41.75 (0.0000)	10.11 (0.0015)	22.35 (0.0000)	152.40 (0.000)	23.79 (0.0800)
Amemiya-Lee-Newey minimum chi-sq statistic of Overidentification restrictions(H_0: Overidentification restirictions are valid	0.00(.)	0.222 (0.6377)	0.00(.)	0.00(.)	0.00 (.)	0.001 (.)

Source: Author's computation

Notes:

1. Marginal effects of coefficients are reported with Z-values in brackets.
2. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels respectively.
3. (.) Represents exactly identified equations

The chi-square test result indicates whether the instruments are weak or strong in explaining malaria occurrence. As earlier mentioned, where the chi-square test coefficient was above the rule of thumb threshold of 10, it implies that the statistically significant instrument(s) was/were strong in explaining the dependent variable. Otherwise, the instrument was weak (Bound *et al* 1995). The test result shows that the statistically significant instrument (s) had non-zero coefficient at 10% level for poor and non-poor groups in the analysis. Urban residents, rural dwellers, male and female levels of analysis reveal that statistically significant instruments were non-zero at 1% level.

The chi-square test result for strength of instruments was above the rule of thumb threshold of 10 except for rural, male, female, poor and non-poor categories and was below the threshold value only for urban individuals. This implies that the statistically significant instrument was strong in explaining malaria except for urban persons. Combination of the statistical significance of the instrument and magnitude of the chi square coefficient indicates that the instrument(s) used was/were strong and relevant except for urban grouping where it was relevant but weak.

Test for over-identification restriction was shown to be valid for rural grouping and exactly identified for urban, male, female, poor and non-poor groupings. The exactly identified equation is as a result of the use of only one instrument in the over-identification test for the specific group of analysis. The test result for over-identification restrictions showed that the statistically significant instrument(s) was/were not correlated with the structural error term. The implication therefore is that the statistically significant instrument(s) was/were suitable for determining the occurrence of malaria in each respective level of the analysis.

5.5.3 Diagnostic Test Results on Validity of Instruments across Geopolitical zones

The results for instrument validity across the six geopolitical zones are presented in Table 5.5c. The geopolitical zones presented in the table are North-Central, North-East, North-West, South-East, South-South, and South- West zones.

A close look at the test for relevance of instruments showed distance to the nearest health centre as statistically significant in explaining malaria incidence in the North-Central and North-East zones. In the North-West, South-East and South-West zones,

the distances to the nearest food market and health centre were statistically significant in explaining malaria incidence. The South–South zone was shown to have the distance to the nearest food market as the statistically significant instrument.

Table 5.5c Relevance of Instruments (Geo-political zone)

Variable/ Geo-political zone	North Central	North East	North West	South East	South-South	South West
Dist_Food	0.0002 (0.29)	0.0000 (0.03)	0.0043 (7.77)***	0.0038 (3.11)**	0.0034 (3.61)**	0.0039 (4.13)***
Dist_health	-0.0023 (-4.03)***	0.0017 (2.46)**	0.0033 (6.19)***	0.0023 (2.02)**	0.0012 (1.30)	-0.0046 (-4.71)**
Joint Chi2 test for H_0: Coefficient on instrument (s)=0 (p-value in bracket)	16.24 (0.001)	6.06 (0.0139)	252.02 (0.0000)	28.57 (0.0000)	13.06 (0.0003)	25.78 (0.0000)
Amemiya-Lee-Newey minimum chi-sq statistic of Overidentification restrictions(H_0: Overidentification restirictions are valid	0.0000 (.)	0.0000 (.)	0.054 (0.8165)	1.050 (0.3065)	0.0000 (.)	1.834 (0.1757)

Source: Author's computation

Notes:

1. Marginal effects of coefficients are reported with Z-values in brackets.
2. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively.
3. (.) Represents exactly identified equations.

The chi-square test result shows that the statistically significant instrument (s) have non-zero coefficient at 1% level for all zones. The chi-square test coefficient was above the rule of thumb threshold of 10 for all zones except the North-East region. This implies that other than the North-East zone, the instrument(s) used for each geopolitical zone was/were strong and relevant.

Test for over-identification restriction was shown to be valid across all zones. Due to statistical significance of only one instrument, test results for over-identification restrictions were exactly identified in the North-Central, North East and South-South zones. Results for over-identification restrictions therefore suggest that selected instrument(s) was/were not correlated with the structural error term. The statistically significant instrument(s) is/are thus suitable for the potentially endogenous variable across the respective zones.

5.5.4 Summary of Diagnostic Test Results

Overall, the diagnostic test results indicate that the instruments chosen for the analysis; distances to the nearest food market and health centre were both relevant for the analysis at the national level, rural grouping, and self-employment in agriculture, North-West, South-East and South-West regions. The distance to the nearest health centre was relevant in explaining malaria occurrence for urban dwellers, females, formal employment workers, wage employment, non-poor group, North-Central and North-East zones. On the other hand, the distance to the nearest food market was relevant in explaining malaria incidence of informal employment workers, owned account workers, males, individuals who were poor and South-South residents. Relevant instrument(s) were statistically significant and show valid over identification restrictions.

Relevant instrument(s) were strong for all categories of analysis with the exception of formal, wage, other self-employment, urban area and North-East zone. The level of analysis where instrument(s) was/were weak did not make the instruments inappropriate for explaining malaria incidence, because they fulfilled the validity criteria of statistical significance and valid over-identification restrictions.

5.6 Probit Results for Effect of Malaria on Labour Employment Probability

The study made use of valid instrument(s) in the respective groups of the analysis to determine the effect of malaria on labour employment. The instrumental variable probit regression results for the effect of malaria on labour employment are shown in tables 5.6a, b and c. Table 5.6a shows the effect of malaria on participation decision across employment types, while Table 5.6b shows malaria effect on employment decision across place of residence, gender and income groups. Table 5.6c shows malaria effect on employment decision across the geopolitical zones.

The instrumental variable probit regression results also report exogeneity test results between malaria and labour employment. The results reported are marginal effects of instrumental variable probit regression where endogeneity exist between malaria and labour employment. Otherwise, results reported are marginal effects of probit regression. Reporting marginal effects enables the interpretation of the results in terms of the magnitude of the parameter estimates.

The table also shows the likelihood ratio (LR) statistics[43] and the predicted probability of positive outcome for each level of analysis. The predicted probability is the predicted outcome for binary variables defined as 0 to1. The difference between the predicted outcome and actual outcome is used to explain the overall model performance[44]. This difference is related to the concept of goodness of fit of a model such that models with good fit indicate smaller differences between the predicted and observed outcomes. Following results extracted from instrument validity, only instruments relevant in explaining malaria for a level of analysis is/are included in estimating the labour employment probability for that level.

[43] The LR statistics is the equivalence of the F-test in linear regression models which tests the null hypothesis that all the slope coefficients are simultaneously equal to zero. It follows the Chi^2 distribution with degree of freedom equal to the number of explanatory variables in the sample excluding the intercept (Gujarati D.N. 2004, pg 613)

[44] See Steyerberg *et al* 2010 for more explanation on the predicted outcome of a variable whether for a continuous or categorical variable. Allison (2013) further reiterates the usefulness of the predicted outcome on how well the model fits the data.

5.6.1 Probit Regression Results for Effect of Malaria on Labour Employment Decision across Employment Types

The result for the effect of malaria on employment decision shows that the illness contributes to existing unemployment figures in Nigeria. Results for malaria effect on employment probability across employment groupings are presented in Table 5.6a. The table also shows findings on the extent to which socioeconomic variables included in the regression analysis affect the probability of labour employment.

Results for LR statistics show that the explanatory variables are collectively statistically significant at 1% for each group of the analysis. The predicted outcome value for each level of analysis suggests good fit of the model by the sample data. The predicted outcome figure reveals that over 70% of the variation in the dependent variable was predicted by the independent variable for each level of analysis. The exogeneity test result on the other hand, shows the existence of endogeniety between malaria and labour employment decision for all employment groupings of the study. Hence, parameter estimates presented in the table are from instrumental variable probit regression model.

Table 5.6a Probit Regression Estimates for Labour Employment Probability across Work Types.

Variable/ Level	All	Informal	Formal	Formal/Informal	Informal (Self-Employment)	
				Wage Employment	Self-employment in Agriculture	Other Self-employment (Owned account)
Malaria_2wks	-0.783 (-36.77)***	-0.798(-43.71)***	-0.769(-9.81)***	-0.778(-10.26)***	-0.742(-11.28)***	-0.776(-14.97)***
Logincome	0.050(8.84)***	0.047(6.72)***	0.040(2.49)***	0.038(2.12)**	0.027(2.43)**	0.045(5.1)***
Education: No Education is the reference category						
Prim_Edu	0.005(0.37)	0.000(-0.03)	0.089(1.96)**	0.086(2.1)**	-0.023(-1.21)	0.027(1.22)
Sec_Educ	-0.026(-2.02)**	-0.037(-2.7)***	0.064(1.56)	0.055(1.44)	-0.062(-3.26)***	-0.038(-1.75)*
Tert_Educ	-0.042(-2.86)***	-0.074(-3.94)***	0.071(1.74)*	0.065(1.66)*	-0.108(-3.84)***	-0.089(-3.04)***
Age	0.011(3.76)***	0.014(4.34)***	0.027(1.67)*	0.029(1.87)*	0.013(3.61)***	0.017(2.13)**
Agesquared	-0.000(-2.68)***	0.000(-3.22)***	0.000(-1.45)	0.000(-1.63)*	0.000(-2.38)**	0.000(-1.86)*
Gender : Female is the reference category						
Gend_male	-0.061(-4.69)***	-0.053(-3.35)***	0.014(0.42)	0.014(0.41)	-0.014(-0.48)	-0.029(-1.59)
Place of Residence: Rural area is the reference category						
Urban	0.040(3.65)***	0.048(4.01)***	-0.014(-0.83)	-0.012(-0.75)	-0.023(-1.5)	0.005(0.34)
kids0004	-0.003(-0.6)	-0.002(-0.49)	-0.001(-0.06)	0.00(0.05)	-0.008(-1.23)	0.014(1.87)*
kids0509	0.012(2.62)***	0.014(2.74)***	0.024(2.26)**	0.023(2.21)**	0.016(2.41)**	0.018(1.97)**
Observation	14,684	11,685	2,524	2,610	6,290	5,248
LR(Wald chi^2)	1,971.430***	1,808.130***	676.280***	578.470***	300.990***	2,738.500
Predicted Probability of positive outcome	0.720	0.740	0.680	0.690	0.740	0.690
Wald Test of Exogeneity (H_0: malaria is exogenous)	42.93(0.00)***	34.33(0.00)***	8.95(0.00)***	8.21(0.00)***	16.50(0.00)***	20.23(0.00)***

Source: Author's computation

Notes:

1. Marginal effects of coefficients are reported with Z-values in brackets.
2. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively

Results from the table shows that malaria has significant negative effects on employment probability in Nigeria. Findings at the national level suggest that on the average, having malaria reduces the probability of being employed in the labour force by as much as about 78%. This is an indication that high prevalence of malaria in Nigeria reduces income prospects and hampers economic progress. Malaria can hence be considered to be a major obstacle to welfare improvements and economic growth in the country.

The result further indicates that the informal nature of the Nigerian economy predisposes labour to more hazardous effect of malaria. An examination of the results for formal and informal sector employment shows that malaria negatively affects the probability of participating in the informal sector by about 80% and in the formal sector by about 77%. The higher unfavourable effect of malaria on the probability of being employed in the informal sector relative to the formal can be linked to the fact that informal sector employments require more of physical labour. Hence, employment in such work type is more hampered by the morbidity effect of the illness. This result is as expected and worrisome given that majority of the Nigerian workforce are likely to be engaged in the informal sector.

The results for wage and self-employment show that malaria reduces the probability of being employed in wage and other self-employment than self-employment in agriculture. Persons with malaria are approximately 78% less likely to be employed in wage and other self-employment types and are about 74% less likely to be engaged in self-agricultural employment. Morbidity effect of malaria would have been expected to reduce employment probability in the agriculture sector than other employment types because of the highly labour-intensive method of production in the Nigerian agricultural sector. However, the relatively lower effect of malaria in agricultural employment than wage and other self-employment can be attributed to subsistence production which requires less effort. Individuals employed in the agricultural sector are in most cases engaged in such work type for household food consumption; while ill with malaria, such individuals will necessarily engage in production activities for survival purposes. This worsens health conditions of such group of persons and induces reduction in marginal productivity of labour.

Findings on the effect of other socioeconomic variables on labour employment show that an increase in income, for instance, has positive effect on the decision to be employed in the labour force. This is an indication of high poverty prevalence in the country and is in line with findings by Contreras *et al* (2010), which showed that participation in the labour force increases with a rise in income particularly for persons who are not from rich households.

National level results showed that an increase in per capita household income by 1% raises the probability of labour employment by approximately 0.05%. Similarly, an increase in per capita household income by 1% raises the probability of employment in informal and other self- employment types by approximately 0.05%. Employment probability in formal and wage employment also increases by about 0.04% with a 1% increase in income. Participation in self- agricultural employment increases by about 0.03% with a 1% rise in income. The relatively low positive effect of income on the probability of participating in agricultural self-employment can be linked to general unwillingness of the Nigerian labour force to participate in agricultural activity. This relates with the highly subsistence nature of production in this sector and poor storage techniques when labour decides to produce agricultural output in large-scale.

Findings from the study further suggest that having higher educational attainment did not necessarily increase the probability of been employed in Nigeria. The results show that having primary education has no significant effect on the probability of being employed in the labour force. This applies to all employment type except, formal and wage work. On the other hand, having secondary and tertiary education reduced the probability of being employed except for formal and wage work. This suggests that higher educational attainment reduces employment chance in the informal sector and hence, boosts the chance of getting jobs only in formal and wage work types. Negative effects of secondary and tertiary educational attainment on participation further implies that having higher educational attainment does not raise economic empowerment of individuals, but only prepares them for white collar job. This result suggests that unemployment particularly among educated individuals in Nigeria is as a result of insufficient formal work types in the country and unwillingness of educated persons to undertake informal employment. The low tendency of employment choice in the

labour force by educated persons further implies that most educated persons in Nigeria are not economically empowered to cater for their financial needs.

Significant and positive effect of educational advancement on choice of being employed in formal and wage work are noticeable only with having primary and tertiary education. Persons with primary education are about 9% more likely to be employed in formal and wage work than those with no educational attainment. While those with tertiary education, are about 7% more likely to be employed in formal and wage employment than those with no educational qualification.

Aside formal and wage work, having primary education did not have any significant effect on labour employment. National level estimates show that individuals with secondary and tertiary education are approximately 3% and 4% respectively less likely to be employed in the workforce than those with no educational qualification. Having secondary and tertiary education reduces the likelihood of being employed in the informal sector by approximately 4% and 7% correspondingly than having no educational requirement. Similarly, holders of secondary and tertiary education are about 6% and 11% less probable to be engaged in self-agricultural employment. Secondary and tertiary educational holders also show approximately 4% and 9% respectively less probability of being employed in other self-employment types. This statistics further shows that persons with tertiary education are the most unlikely set of persons to be engaged in self-agricultural production. This depicts that educational attainment could be a contributing factor to reduced labour involvement in agricultural production in Nigeria. It also signifies that as more persons get educated in Nigeria, the work- force in the agricultural sector as well as agricultural production will fall. In this light, the economy will have to rely on import of food items rather than home production.

The result on the effect of educational attainment on the probability of labour employment conforms to findings by Swaminathan and Lillard (2000) which showed that educational attainment reduces the probability of labour participation in Indonesia when health and income are included in the labour force participation equation.

As expected, results for the effect of age on employment likelihood indicate that increase in age within the economically active population raises the probability of

employment in the labour force. Advancement in age beyond that of the economically active population has negative effects on the probability of being employed in the labour force. This result corroborates findings by Aminu (2010) who had earlier shown that ageing has negative influence on the likelihood of participating in the Nigerian labour force. Machio (2012) also indicated similar findings on age effects on employment decisions in Kenya.

Findings on gender shows that males are generally less likely to get employed in the Nigerian labour force than females. This can be associated with the predisposition of females to informal sector work; a notable feature in the Nigerian economy. In addition, the need to provide financial support for the household given high poverty incidence in the country can be a motivation for increased tendency of female participation in the country. This result implies that females in the economically active population combine home upkeep and childcare with economic activities. This has unfavourable implications on female health status and societal value system for childcare.

In terms of gender, national level estimates show that males are about 6% less likely to be employed in the labour force than females. They are also approximately 5% less likely to participate in informal sector work than females. The probability of male participation in self-agricultural employment and other self-employment types are respectively about 1% and 3% less than female participation. The result also shows that there are no significant differences in male and female participation in formal and wage work type. Findings for higher tendency of female participation in the workforce than male was similar to conclusions reached by Gannon and Nolan (2003) on disability effects of labour participation decisions in Ireland.

Results for place of residence suggest that individuals who reside in the urban areas are more likely to be engaged in economic activity than those in the rural areas. National level estimates show that persons who live in the urban areas are on the average, 4% more likely to participate in economic activity than those in the rural areas. They are also on the average 5% more likely to be engaged in informal work type particularly owned account than rural dwellers. This result suggests that unemployment is relatively higher in the rural than urban areas in Nigeria. It also

explains the underlying poverty prevalence in rural parts of the country. Similar results were obtained by Contreras *et al* (2010) and Aminu (2010).

The results further showed that living with children aged 0 to 4 years has no significant effect on the probability of being economically engaged in the labour force except in other self-employment where it has significant positive effects. The positive effect of living with children 0 to 4 years on the probability of participating in other self-employment is attributable to the nature of self- employment such as tending a small store at home. Such work type can be performed simultaneously with child care. This result is similar to findings by Smith (1981). It is however contrary to Machio (2012) who showed that in Kenya, having children five years and below reduces the probability of labour force participation.

Findings from the study also suggest that having older children aged 5 to 9 years of age raises the probability of employment in the labour force. Meeting financial demand for older children such as educational expenditure as well as reduced need for child attention can account for the incremental effect of having older children on the probability of labour employment.

5.6.2 Probit Regression Results for Effect of Malaria on Labour Employment across Place of Residence, Gender and Income Groups

There are variations on the effect of malaria on labour employment decisions of individuals in Nigeria with reference to gender and income groups. Findings on the effect of malaria on labour force employment for place of residence, gender and income groups are presented in Table 5.6b. The analysis examined place of residence in terms of urban and rural areas. Gender groupings are separately presented for males and females while income groups are examined for poor and non- poor persons. Results on socioeconomic variables effect on choice of labour employment are also presented for the different categories considered in the table.

The results show that for all groupings of analysis, the variables are collectively statistically significant at the 1% level. This is shown by the statistically significant LR statistics for all levels of the analysis. The predicted outcome value for each level of analysis suggests good fit of the model by the sample data. The predicted outcome figure shows that over 70% of the variation in the dependent variable was predicted by

the independent variable in each level of analysis. The exogeneity test result for each level of the analysis shows existence of endogeneity between malaria and labour force employment across place of residence, gender and income groups. The results presented are therefore marginal estimates of the instrumental variable probit model.

The results in Table 5.6b show that negative effect of malaria on employment probability is approximately not different between urban and rural dwellers. This suggests that an individual's place of residence did not determine the magnitude of malaria effect on the probability of being employed in the labour force. Regardless of place of residence, persons ill with malaria are approximately 78% less likely to be engaged in economic activity compared to those who are healthy.

Positive effect of increase in income on labour force participation, is slightly higher for rural than urban dwellers. On the average, an increase in income by 1% raise the probability of labour employment by about 0.04% for urban dwellers and approximately 0.05% for rural dwellers. This result gives inkling to higher poverty incidence in the rural than urban areas and buttresses findings by Contreras *et al* (2010) that individuals from rich households will engage less in economic activity even with increase in income compared to those from poor households.

Table 5.6b Probit Regression Estimates for Labour employment probability across Place of Residence, Gender, and Income

	Place of residence		Gender		Income groups	
Variable/Level	**Urban**	**Rural**	**Male**	**Female**	**Poor**	**Non poor**
Malaria_2wks	-0.778(-7.73)***	-0.777(-46.66)***	-0.761(-21.4)***	-0.813(-73.78)***	-0.743(-13.12)***	-0.825(-5.32)***
Logincome	0.043(3.03)***	0.052(7.81)***	0.051(7.8)***	0.047(3.43)***	0.063(5.30)***	0.037(5.13)***
Education: No Education is the reference category						
Prim_Edu	0.006(0.21)	0.004(0.26)	0.003(0.18)	0.011(0.35)	-0.019(-1.02)	0.003(1.64)*
Sec_Educ	-0.048(-1.86)*	-0.020(-1.26)	-0.026(-1.8)*	-0.009(-0.28)	-0.004(-2.03)**	-0.001(-0.03)
Tert_Educ	-0.080(-2.57)***	-0.016(-0.91)	-0.037(-2.29)**	-0.028(-0.78)	-0.053(-1.69)*	-0.193(-1.030)
Age	0.013(0.92)	0.007(2.4)**	0.004(0.89)	0.0343(6.24)***	0.012(1.64)*	0.013(3.63)***
Agesquared	-0.000(-0.76)	-0.000(-1.31)	-0.000(-0.23)	-0.000(-5.28)***	-0.000(-1.20)	-0.000(-2.68)***
Gender: Female is the reference category						
Gend_male	-0.006(-0.15)	-0.107(-7.39)***	omitted	Omitted	-0.061(-3.83)***	-0.045(-2.170)**
Place of residence: Rural area is the reference category						
Urban	omitted	Omitted	0.052(3.25)***	-0.045(-2.18)**	0.034(1.22)	0.052(4.59)***
kids0004	-0.005(-0.69)	0.000(0.04)	0.000(0.04)	0.020(1.2)	-0.004(-0.45)	0.001(0.22)
kids0509	0.0108(2.25)**	0.010(1.74)*	0.011(2.25)**	0.050(2.44)**	0.013(1.89)*	0.012(2.02)**
Observation	5,441	9,277	12.989	1,806	6,496	8,43
LR (Wald chi^2)	1,868***	462.13***	2,049.94***	457.83***	1276.40***	610.06***
Predicted Probability of positive outcome	0.71	0.72	0.70	0.77	0.68	0.78
Wald Test of Exogeneity (H0: malaria is exogenous)	3.90(0.05)**	40.40(0.00)***	21.55(0.00)***	27.77(0.00)***	8.293(0.00)***	19.57(0.00)***

Notes:

1. Marginal effects of coefficients are reported with Z-values in brackets.
2. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels respectively

Source: Author's computation

The result also shows that educational attainment affects the probability of being employed in the labour force only for persons who reside in the urban areas. There are no significant effects of educational attainment on the probability of employment in the labour force for rural dwellers. The result shows that urban dwellers with secondary and tertiary educational qualification are respectively about 5% and 8% less likely to be employed in the labour force compared to those with no educational qualification. This may be attributed to the fact that urban areas are characterised by more educated individuals and hence the teeming population of educated persons may not be absorbed based on the available jobs. Individuals in the urban areas with no educational attainment are thus more likely to get employment than those with formal education. This can be attributed to demand for menial services commonly provided by non- educated persons in urban settlements.

The results further show that males have lower probability of being employed in the labour force than females. The effect is higher in the rural than the urban areas. This result suggests male preference for formal jobs that characterise urban than rural areas. Male preference for formal work type hence implies that they will be more likely engaged in economic activity when they reside in the urban than rural areas.

Findings for urban and rural areas further shows that living with children 0 to 4 years have no effect on the probability of being employed in the labour force. On the other hand, living with children, age 5 to 9 years raises the likelihood of labour employment both in the urban and rural areas. The result implies that having young children has no significant negative effect on employment probability. This is largely due to the highly informal nature of the Nigerian economy which allows for performance of economic activity even from the home front.

Results for gender shows that malaria has higher negative effects on the probability of female labour employment than males. Females with malaria are about 81% less likely to be employed in the labour force while males ill with malaria show approximately 76% less probability of participating in the workforce. This result suggests that negative effects of malaria on earning prospects are higher for females than males. On the other hand, it is an indication that male valuation of the opportunity cost of time spent seeking good health is higher than that of females.

Results for income across male and female groupings show that income is positively related with male labour employment decision than females. The high financial demand placed by the society on male income than female income can be a motivation for higher male employment likelihood when income increases.

Findings from the study also show that educational attainment has significant effect only on the likelihood of male employment. Males with secondary and tertiary education are less likely to be employed in the labour force than males with no education. This result suggests higher unemployment rates for educated than uneducated males. On the other hand, educational attainment has no effect on females labour force participation. None significant effect of education on female labour force participation can be as a result of high female involvement in the informal sector which does not necessarily require any form of educational attainment (Table 5.3).

The result further reveals significant effect of age on the probability of labour employment only for females. Female labour force participation falls with aging beyond the age limit of the economically active population. This implies that having females within the age group of the economically active population increases prospects for improvement in household welfare through female supplementary income. It also raises female contribution to total output in the Nigerian economy. Findings of the study also show that living with young children has no significant effect on employment decisions in Nigeria whether for male or female individuals. However, living with children aged 5 to 9 years significantly increases the likelihood of participating in the labour force for males and females. This result implies that labour contributions to economic output are not in any way affected by having young children. Interestingly, labour contribution to economic output rises as children grow older.

The findings for income groupings imply that poor persons with malaria are prone to higher depreciation in health status than those who are non-poor. This is because individuals who are poor have relatively higher probability of being engaged in economic activity when ill with malaria compared to those who are rich. Individuals from poor households are shown to have about 74% less likelihood of being employed in the labour force when ill with malaria. On the other hand, those who were from non-poor households show approximately 85% less tendency to be engaged in income

earning activity when ill with malaria. The result suggests that individuals who are poor may not take out sufficient time to recuperate from the illness before engaging in income earning activity. Persons who are from non-poor household attach less weight to the opportunity cost of time when ill and hence can afford not to engage in economic activity during illness. With high poverty figures in Nigeria, the result suggests that malaria induces mass reduction in health status of the populace and contributes to poor development indices.

In line with earlier discussions of the study, the effect of increase in income on the probability of labour employment is higher for persons from poor households than those from non-poor households. The result of the study shows that 1% increase in per capita household income raised the likelihood of labour employment by about 0.06% for individuals from poor households and by approximately 0.04% for non-poor persons. This result emphasize empirical findings of the study and earlier conclusions by Contreras *et al* (2010) that individuals from affluent households participate less in the labour force even with a prospective rise in income.

Results for educational attainment show that higher educational attainment particularly for secondary and tertiary education has no differential effect on the probability of labour employment for individuals from non-poor households. Thus, those who are non-poor do not necessarily have to get higher educational qualification to be gainfully employed. On the other hand, higher educational attainment reduces the probability of labour employment for persons who are poor. The result shows that poor persons with secondary and tertiary education are respectively about 0.4% and 5% less likely to be employed in the labour force than those with no educational qualification. The result suggests that even with acquired skills and work ethics from formal education, poor persons are likely to remain poor. This is because the poor are less likely to get employed regardless of educational qualification. On the other hand, rich individuals do not necessarily have to get required skills and abilities acquired through higher educational pursuit for gainful employment. Thus, those who are rich commonly get economic empowerment regardless of educational qualification.

Results for gender differences across poor and non-poor households show that males from poor households participate less in the labour force, than those from non-poor households. Males from poor households are on the average 10% less likely to be

employed in the labour force than females from poor households. On the other hand, males from non-poor households are on the average 2% less likely to participate in the labour force than females from non-poor households. This suggests that females from poor households are more engaged in economic activity than females from non-poor households. This result can be attributed to higher reservation income that undeniably characterise females from non-poor household which can deter motivation to be engaged in economic activity.

The findings further indicate that non-poor individuals who live in the urban areas record higher probability of being employed in the labour force than non-poor persons living in the rural centres. Non-poor persons who live in the urban areas are 5% more likely to be employed in the labour force than those in the rural areas. On the other hand there are no differences in the probability of labour employment among urban poor individuals and rural poor persons. Hence, place of residence affects labour employment of only of non-poor persons.

Results for living with young children across income groups show that having children aged 0 to 4 years raises the probability of labour employment for persons from non-poor households. On the other hand, living with children aged 0 to 4 years has no significant effect on employment probability of poor persons. Positive relationship between having young children age 0 to 4 years and labour employment of non-poor persons can be explained by the fact that individuals from non-poor households are financially buoyant enough to employ services of home keepers to cater for young children when engaged in work activities. On the other hand, work type of persons from poor household; most likely informal in nature will not deter participation in the labour force. Overall, living with children aged 0 to 4 years did not significantly hamper earning ability and labour output.

The result gives support to earlier findings that living with children aged 5 to 9 years have positive significantly effect on the probability of labour employment. This effect is shown only for persons from poor households. Having children aged 0 to 5 years has no significant effect on labour employment of non-poor individuals. The increase in financial demand for child upkeep as children grow older can be a motivation for higher labour employment probability of individuals from poor households. Persons from non-poor households on the other hand may not experience as much pressure as

those from poor households in meeting financial needs of older children. This possibly explains none significance of having older children on the likelihood of labour employment of non-poor individuals.

5.6.3 Probit Regression Results for Effect of Malaria on Labour Employment across Geo-political Zones.

The effect of malaria on employment probability is higher for some geopolitical zones than others. On the other hand, employment decisions of labour are not affected by the scourge of malaria in some of the geopolitical zones in Nigeria. Table 5.6b presents findings for malaria effect on labour employment across the six geopolitical zones in Nigeria. The table also shows results of effects of other socioeconomic variables on the probability of labour employment across the six geopolitical zones.

The LR statistics shows that collectively, the variables are statistically significant at the 1% level for each region. The predicted outcome value suggests good fit of the model by the sample data for all zones. Across all zones, the predicted outcome figure shows least variation of 50% predictability of the dependent variable by the explanatory variables. The exogeneity test results show non- acceptance of the null hypothesis for exogeneity of malaria and labour employment in all zones except for the North-Central, North-West, and South–West zones. Results presented for the North- Central, North-West and South-West zones are marginal effects of probit regression estimates without using instruments. Results for the North-East, South-East and South-South are from instrumental variable probit regression models.

Table 5.6c Probit Regression Estimates for Labour Employment probability across Geopolitical Zones

Variable	North-Central	North-East	North-West	South-East	South- South	South-West
Malaria_2wks	0.027(0.49)	-0.584(-49.08)***	-0.274(-5.19)***	-0.746(-20.65)***	-0.824(-49.95)***	-0.022(-1.21)
Logincome	-0.008(-0.82)	0.032(2.32)**	0.002(0.21)	0.095(7.87)***	0.021(1.06)	0.007(1.35)
Education: No Education is the reference category						
Prim_Edu	0.063(2.06)**	-0.022(-0.41)	-0.047(-1.58)	-0.021(-0.82)	-0.006(-0.21)	-0.007(-0.33)
Sec_Educ	0.069(2.24)**	-0.049(-0.96)	-0.027(-0.94)	-0.026(-0.9)	-0.049(-1.78)*	-0.025(-1.21)
Tert_Educ	0.064(2.04)**	-0.045(-0.94)	-0.044(-1.39)	-0.050(-1.55)	-0.012(-0.32)	-0.071(-2.75)***
Age	0.012(2.25)**	0.008(0.85)	-0.006(-1.07)	0.003(0.4)	0.013(2.05)**	0.025(10.55)***
Agesquared	-0.000(-1.76)*	-0.000(-0.55)	0.000(0.9)	0.000(0.13)	-0.000(-1.62)	-0.000(-9.91)***
Gender: Female is the reference category						
Gend_male	-0.035(-1.14)	-0.297(-5.91)***	0.270(4.65)***	-0.054(-2.47)***	-0.000(-0.01)	0.023(2.09)**
Place of residence: Rural area is the reference category						
Urban	0.069(4.12)***	0.11102.87)***	0.054(3.19)***	0.076(2.98)***	-0.076(-2.94)***	-0.034(-3.87)***
kids0004	-0.008(-0.93)	-0.002(-0.15)	0.005(0.58)	0.000(0.02)	0.017(1.52)	0.010(1.45)
kids0509	-0.014(-1.33)	0.033(2.32)**	0.014(1.7)*	0.019(1.6)	0.012(1.13)	0.021(2.73)***
Observation	2,856	1,311	1,989	2,232	3,133	3,347
LR (Wald chi^2)	51.02***	849.65***	130.93***	1249.41***	505.78***	244.75***
Predicted Probability of positive outcome	0.82	0.52	0.89	0.66	0.79	0.94
Wald Test of Exogeneity (H_0: malaria is exogenous) p value in bracket	1.11 (0.29)	20.11 (0.00)***	2.23 (0.14)	28.74 (0.00)***	4.16 (0.04)**	1.82 (0.18)

Notes:

1. Marginal effects of coefficients are reported with Z-values in brackets.
2. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively

Source: Author's computation

The results show that probability of labour employment for individuals who live in the North-Central and South-West regions are not affected by malaria. Negative effects of malaria on labour employment are observed in four zones; the North-East, North-West, South-East and South-South. The result for malaria effect on employment probability in the North-Central region is expected given low prevalence of malaria in the North-Central part of the country relative to other zones (Table 5.1). Findings for malaria effect on employment probability in the South-West is contrary to expectations given that the region is categorised as one of the forest zones which creates conducive environment for breeding mosquitoes. The South-West zone is characterised by high literacy rates which can positively influence efficiency and effectiveness in the use of preventive and curative strategies to curb malaria. In addition, the zone is characterised by high commercial activity and business organizations with obligation of social responsibility one of which could be creating awareness and control methods for malaria. In southern Nigeria, the South-West zone records lowest prevalence of malaria (Table 5.1)

The results show that individuals with malaria in the North-East zone are on the average 59% less likely to engage in economic activity than those who are healthy. Persons ill with malaria in the North-West region are on the average 27% less likely to be employed in the labour force than those who are healthy. Individuals with malaria in the South-East and South-South zones are respectively about 75% and 82% less likely to be employed in the labour force, compared to those who are healthy. This result suggests that negative effects of malaria on the probability of labour employment are highest in the South-South part of the country. This is followed closely by the South-East, North-East and North-West zones. Malaria therefore hampers income prospects and contributions of labour to economic growth for South-South dwellers than any other zone in Nigeria.

In the North-Central region, variables that determine the probability of labour employment include; educational attainment, age and place of residence. Unlike previous findings in the study, individuals in the North-Central region with primary, secondary or tertiary education are more likely to be employed in the labour force than persons with no education. This indicates that education plays a vital role in the probability of labour employment in the North-Central zone. As expected, an increase

in age is positively related to the probability of labour employment while aging induced less likelihood of labour engagement in economic activity. The results also shows that North-Central urban dwellers are on the average 7% more likely to be employed in the labour force than North central rural dwellers. The result further shows that living with children 0 to 4 and 5 to 9 years has no significant effect on labour employment for North –Central dwellers. This implies that living with young children does not affect labour income prospects and input to GDP for persons who live in the North-Central part of the country.

In the North East, variables that influence the probability of labour employment aside malaria are per capita household income, gender, place of residence and having children 5 to 9 years. In line with previous findings in this study, increase in per capita income has significant positive effect on the probability of labour employment in the region. Likewise, males in the region are less likely to participate in the labour force than females. North-East urban dwellers are shown to be more likely employed in the labour force than persons in the rural areas. Individuals in the urban areas are on the average 11% more likely to be employed in the labour force than those in the rural areas. Also, similar to the findings in this study, living with children aged 5 to 9 years increases the probability of labour employment in the North-East.

Results for the North-West show that aside malaria, the probability of labour employment is determined by gender and place of residence. Results for gender on labour employment are surprisingly different from previous results of the study. Male residents in the North-West region are more likely to be employed in the labour force than females. Males in the region are on the average 27% more likely to engage in economic activity in the labour force than their female counterpart. This effect can be associated with cultural and religious bias against female labour force participation in the zone. Result for place of residence show that North-West urban dwellers are on the average 5% more likely to be engaged in economic activity in the labour force than North West rural residents. The result also shows that living with children aged 5 to 9 years raise the tendency to be engaged in income earning activity for persons who reside in the North-West.

In the South-East, variables that significantly determine the probability of labour employment apart from malaria are income, gender and place of residence. As shown

in previous results of the study, an increase in income has positive effect on the probability of labour employment of South-East dwellers. Similarly, males in the region are less likely to participate in the labour force than females. Results for place of residence also show that urban dwellers in the South-East zone are approximately 8% more likely to be employed in the labour force than rural South-East dwellers. This finding is also in line with results for most of the level of analysis considered in this study. The result also indicates that living with children aged 0 to 4 and 0 to 5 years has no significant effect on the decision to be employed in the labour force for South-East dwellers.

In the South-South, variables that significantly explain the probability of labour employment apart from malaria include; secondary educational attainment, age and place of residence. In line with other findings for most of the analysis in this study, individuals with secondary school educational attainment in the South-South zone are less likely to be employed than those with no education. In the same vein, increase in age within the age bracket of the economically active population has positive effects on the probability of South-South dwellers participation in the labour force. One shocking result different from previous findings for other levels of analysis in this study is that urban dwellers in the South-South are less likely to be economically engaged than South-South rural populace. In the South-South, individuals in the urban areas are on the average about 8% less likely to be employed in the labour force than those in the rural neighbourhood. The South-South part of the country is generally endowed with fertile land and rainfall that encourage agricultural activities. It is thus possible that employment activities are better generated in the rural than urban areas through agricultural production activities and ancillary industry production related to agriculture. This is because individuals in the rural areas commonly engage in agricultural work type than those in the urban areas. The result shows that living with young children does not significantly influence employment probability in the labour force for South-South dwellers.

As earlier stated, there was no significant effect of malaria on the probability of labour employment for individuals in the South-West. Variables that significantly explained the probability of labour employment in the region are tertiary educational attainment, age, age squared, gender, place of residence and living with children aged 5 to 9 years.

As shown in most levels of analysis in this study, individuals with tertiary education in the South-West are less likely to be employed relative to those with no education. In the same light, increase in age is positively related to the probability of labour employment. However, ageing initiates less possibility of being employed in the labour force. It can also be observed that contrary to findings for most of the levels of analysis in the study, males in the South-West have higher probability of being employed in the labour force than females. Males in the South-West are on the average about 2% more likely to be engaged in the labour force than females. This result is similar to that for gender in the North-West zone. Also, different from findings in this study for other levels of analysis is that urban dwellers in the South-West are less likely to engage in economic activity than rural inhabitants. This finding is similar to that for the South-South region. The result can be attributed to climatic condition in the South-West, which makes forest plantations and engagement in agricultural activity rewarding and attractive. This provides employment opportunity for rural dwellers. The agricultural sector can thus account for more job opportunity in the rural parts of the zone than those in the urban areas. The study results also show that living with children aged 5 to 9 years significantly increased employment probability for South-West dwellers.

5.7 Estimates of Workdays and Productivity Loss to Malaria

Given that persons who fall ill with malaria sometimes require caregiver's attention, the study provided estimates for productivity loss for the patient and the caregiver. Computations for productivity loss were provided using individuals in the economically active population who were gainfully employed. The results presented show workdays lost due to malaria and then monetises workdays lost by multiplying total number of days lost with daily income[45]. This approach which follows the HCA of estimating indirect costs provided a value of the opportunity cost of time lost to malaria illness.

It was observed that from a total of 5116 persons who had malaria in two weeks prior to the HNLSS survey, 2554 (50%) persons indicated lost workdays due to the illness. This implies that one in two individuals in the economically active population who fell

[45] The study made use of per capita household income as a measure of individual income. Productivity loss for an individual is determined as a product of mean workdays loss and mean income value for persons in the economically active population who missed workdays as a result of malaria

ill with malaria experienced some loss in labour contribution to economic output. The study hence determined mean values of workdays lost and productivity loss using the fraction of the sample population who indicated that they missed workdays as a result of the illness. Total workdays lost from an episode of malaria were determined for a one month period.

The results for productivity loss from an episode of malaria for the patient and the caregiver are presented in Tables 5.7a, b and c. Table 5.7a showed findings for productivity loss across employment types and Table 5.7b presents findings for productivity loss across place of residence, gender and income groups. Table 5.7c provides study findings for productivity loss for the six geopolitical zones in the country.

5.7.1 Estimates of Workdays and Productivity Losses from Malaria across Employment Types

Analysis of workdays and productivity losses from malaria indicates disproportionate effect of the illness across various employment categories in the study. Results for productivity loss from a bout of malaria across the different employment groupings are presented in Table 5.7a. The table shows mean workdays and daily income losses to one bout of the illness. The results are presented for the patient with malaria and the respective caregiver.

Results at the national level indicate that individuals and their caregivers lose an average of six and five workdays respectively to an episode of malaria. Daily income losses by malaria patients and their caregivers are about ₦5, 532.59 and ₦ 4,828.73 respectively. These culminate to average total productivity loss of approximately ₦ 59, 586 per episode of the illness. Alaba and Alaba (2009) showed that malaria patients and caregivers in rural Nigeria experience as much as 13 and 4 workdays lost respectively to an episode of malaria. The after effect was productivity loss of about ₦ 7, 743.67.

The result for workdays lost to an episode of malaria across formal and informal employment suggests that malaria has higher detrimental effect on welfare of individuals in the informal than formal sector. This is because when ill with malaria, individuals in the informal sector experience more workdays' loss than those in the

formal sector. This outcome is worrisome because informal employment requires individuals' presence in the workplace to earn income. On the other hand, formal sector employment workers will in most cases, receive monthly income earnings regardless of being absent from work due to illness. Individuals in informal sector employment lose about six workdays when ill with malaria. Caregivers to such individuals lose approximately five workdays. Income loss per day to malaria for informal sector workers and their caregivers are about ₦ 5, 551.96 and ₦ 4, 744.08 respectively. The resultant effect is average productivity loss of about ₦ 6, 0403.20 for patients and the caregivers in the informal sector. On the other hand, malaria patients in formal sector employment and their caregivers lose about five workdays to a bout of malaria. Income loss per day to an episode of the illness for patients and caregivers in the formal sector is shown to be approximately ₦ 5, 758.46 and ₦ 6, 946.32 respectively. Productivity loss per episode of malaria for formal sector workers and their caregivers sum up to an average value of about ₦ 61,128.70. This result suggests that workdays lost by malaria patients in the informal sector and their caregivers were higher than those in the formal sector. However, due to higher daily income earnings received by formal sector employees than those in the informal sector, total productivity loss to an episode of malaria is slightly higher for formal than informal sector workers.

The results also show that there are differences in workdays forgone and productivity loss to an episode of malaria for persons in wage and self-employment. Individuals in wage employment lose relatively fewer workdays to an episode of malaria than those in self-employment in agriculture and other self- employment. Malaria hence induces higher poverty risk for self-employed workers than those in wage employment.

Table 5.7a Average Estimates of Workdays and Productivity Loss per Episode of Malaria across Employment Types

Level/label	Patient			Care giver			Patient and Caregiver
	Workdays lost	Daily Income (₦)	Productivity loss (Indirect cost) (₦)	Workdays lost	Daily Income (₦)	Productivity loss (Indirect cost (₦)	Total Productivity Loss(Indirect cost)
All (National)	6.15	5,532.59	34,047.55*** (*16.24*)	5.29	4,828.73	25,539.10*** *(3.43)*	*59586.70*** (19.67)*
Employment Type							
Informal	6.34	5,551.96	35,221.61*** (*16.11*)	5.31	4744.08	25181.60*** *(3.283)*	60403.20*** *(19.40)*
Formal	5.23	5,758.46	30,099.47*** *(5.68)*	4.47	6946.32	31029.20* *(1.60)*	61128.700*** *(7.29)*
Formal/Informal							
Wage employment	5.31	5,686.40	30,217.52*** (*5.894*)	4.50	6946.32	31258.50* *(1.61)*	61476.00*** *(7.51)*
Informal							
Self-employment in Agriculture	7.05	4,663.40	32,876.96*** *(18.03)*	5.930	3,411.20	20225.00** *(2.447)*	53102.00*** *(20.47)*
Other Self Employment (Owned account)	5.58	7,010.48	39,125.494*** *(8.68)*	4.940	5,555.40	27438.10** *(2.466)*	66563.60*** *(11.15)*

Source: Author's computation

Notes:

1. Mean coefficient reported with t- values in bracket.
2. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels respectively
3. Level of statistical significance was based on conventional tabular t-values of 1.65 at 10%., 1.96 at 5% and 2.58 at 1%.

The results show that individuals in agricultural self-employment and their caregivers lose as much as seven and six workdays respectively to an episode of malaria. Income losses per day by self-employed agricultural sector workers and their caregivers are about ₦ 4, 663.40 and ₦3, 411.20 respectively. This implies that an individual in agricultural self-employment and the caregiver experience average productivity loss of about ₦53, 102.00 to a bout of malaria. Individuals in other self-employment types along with their care givers lose about six and five workdays respectively to an incidence of malaria. Daily income losses by patients and caregivers in other self-employment are approximately ₦ 7, 010.48 and ₦ 5, 555.40 respectively. Average productivity loss by malaria patients in other self-employment and their caregivers is about ₦ 66, 563.60. Persons ill with malaria in wage employment along with their caregivers lose about five workdays each to a bout of the illness. Mean estimates of daily income loss to malaria for wage workers and their caregivers is about ₦ 5,686.40 and ₦ 6,946.32 respectively. Total indirect costs for wage employed workers and their caregiver sum up to about ₦ 61, 476.00. The result indicates that malaria has higher negative effect on labour supply of agricultural sector workers and the least effect on that of wage workers. Due to income differences, indirect cost associated with the illness is highest for persons engaged in owned account work, followed by those in wage employment and for persons in agricultural self-employment.

5.7.2 Estimates of Workdays and Productivity Losses from Malaria across Place of Residence, Gender and Income Groups.

Table 5.7b presents findings for productivity loss from a bout of malaria across place of residence, gender and income groups. Figures for mean workdays' and daily income loss from the illness are also presented in the table. The results are shown for malaria patients and caregivers.

The results show equal numbers of workday's loss by malaria patients in urban and rural dwellers. In urban and rural areas, malaria patients lose approximately six workdays to an episode of the illness. On the other hand, caregivers to patients with malaria in the urban area lose about five workdays while those in the rural areas lose about six workdays to one bout of the illness. Income losses per day by malaria patients and caregivers in the urban area are approximately ₦ 5, 859.03 and ₦ 4, 560.31 respectively. Malaria patients and care givers in the rural areas have daily income loss of about ₦ 5, 390.05 and ₦ 4, 962.93 respectively. Productivity losses to an episode of malaria amount to an average value of about ₦ 57, 751.80 and N60, 576.40 for urban and rural areas respectively. This result suggests higher productivity loss by rural than urban dwellers. This outcome is associated with higher workdays lost and income of rural than urban caregivers.

Table 5.7b Average Estimates of Workdays and Productivity losses per Episode of Malaria across Place of Residence, Gender and Income Groups

Level/label	Patient			Care giver			
	Workdays lost	Daily Income (₦)	Productivity loss (Indirect cost (₦)	Workdays lost	Daily Income (₦)	Productivity loss (Indirect cost (₦)	Total Productivity Loss(Indirect cost)
Place of Residence							
Urban	6.02	5,859.03	3,5242.06*** *(6.46)*	4.94	4,560.31	22,509.70** *(2.52)*	57751.80*** *(8.98)*
Rural	6.20	5,390.05	3,3429.10*** *(17.81)*	5.47	4,962.93	27,147.30*** *(2.69*	60576.40*** *(20.50)*
Gender							
Male	5.89	5,667.24	3,3351.73*** *(15.43)*	4.95	4,196.71	20,777.90** *(2.33)*	54129.60*** *(17.76)*
Female	6.34	5,181.28	3,2833.75*** *(6.94)*	5.45	7,514.79	40,925.60*** *(3.482)*	73759.40*** *(10.42)*
Income groups							
Poor	5.50	1,519.80	8,354.35*** *(13.43)*	4.43	1,450.45	6,424.03*** *(5.81)*	14778.38*** *(19.24)*
Non poor	6.20	7,261.00	45,010.96*** *(15.61*	5.33	6,517.87	34,727.20*** *(3.49)*	79738.20*** *(19.11)*

Source: Author's computation

Notes:

1. Mean coefficient reported with t- values in bracket.
2. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels respectively
3. Level of statistical significance was based on conventional tabular t-values of 1.65 at 10%.,1.96 at 5% and 2.58 at 1%,

The results for gender show that males and females have equal number of workday's loss to a bout of malaria. Males and females experience approximately six days absence from work during illness. Caregivers to male patients lose an average of five workdays while caregivers to females lose about six workdays. Daily income losses by male patients and their caregivers, to an episode of malaria, equals about ₦ 5, 667.24 and ₦ 4, 196.71 respectively. Female patients with malaria and their caregivers experience daily income loss of about ₦ 5, 181.28 and ₦ 7, 514.79 respectively. Total productivity loss to a bout of malaria is on the average approximately ₦ 54, 129.60 for males and their caregivers and ₦ 73, 759.40 for females and their care givers. This indicates higher productivity loss from females than males. This effect is associated with higher daily income and workday's loss of caregivers attending to females than those of males.

Findings for income groupings show same number of workday's loss to a bout of malaria by poor and non-poor persons. Whether poor or non-poor, individuals experience approximately six workday's loss to an episode of malaria. On the other hand caregivers to poor persons with malaria lose about four workdays while those for non-poor lose approximately five workdays. Income losses to malaria from poor persons and their caregivers are about ₦1, 519.80 and ₦ 1,450.45 per day respectively. Non-poor persons and their caregivers experience daily income losses of approximately ₦ 7, 261.00 and ₦ 6, 517.87 respectively. Mean Productivity loss to a bout of malaria by poor persons with malaria and their caregivers amounts to about ₦ 14, 778.38 while that for non-poor and their caregivers is about N79, 738.20. This indicates that productivity loss to malaria for non-poor persons is over five times of those who are poor.

5.7.3 Estimates of Workdays and Productivity Losses from Malaria across Geopolitical Zones.

Analysis of workdays and productivity losses from malaria differs across zones in Nigeria. This is an indication of dissimilar effects of the illness on labour contribution to output in each zone. The results for productivity loss to a bout of malaria across the six geopolitical zones are shown in Table 5.7c. Figures for average workday's and income loss from an episode of malaria are also presented in the table. The results are shown for patients with malaria and the respective caregiver.

Table 5.7c Average Estimates of Workdays and Productivity Losses per Episode of Malaria across Geopolitical Zones

	Patient			Care giver			
Level/Label	**Work days lost**	**Daily Income (₦)**	**Productivity loss (Indirect cost (₦)**	**Work days lost**	**Daily Income (₦)**	**Productivity loss (Indirect cost (₦))**	**Total Productivity Loss(Indirect cost)**
North Central	4.82	4,819.37	23,210.07*** *(4.224)*	4.47	5,086.58	22,742.10** *(2.19)*	45952.20*** *(6.41)*
North East	6.52	6,411.35	41,789.19*** *(4.67)*	5.88	3,847.33	22,622.30* *(1.47)*	64411.50*** *(6.14)*
North West	7.23	4,041.95	29,235.45*** *(13.63)*	5.41	2,019.93	10,921.80* *(1.65)*	40157.20*** *(15.27)*
South East	5.13	7,451.81	38,242.67*** *(4.45)*	4.53	2,932.53	13,269.70*** *(3.10)*	51512.40*** *(7.55)*
South-South	6.11	7,105.48	43,379.00*** *(2.70)*	5.93	5,146.53	30,524.09*** *(10.51)*	73903.10*** *(13.21)*
South West	6.36	5,649.58	35,908.70*** *(7.99)*	5.32	5,055.74	26,886.40* *(1.43)*	62795.10*** *(9.43)*

Source: Author's computation

Notes:

1. Mean coefficient reported with t- values in bracket.
2. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels respectively
3. Level of statistical significance was based on conventional Tabular T-values of 1.65 at 10%.,1.96 at 5% and 2.58 at 1%,

Analysis of productivity loss across the geopolitical zones in Nigeria shows disparity not only in terms of workdays lost to malaria but also with reference to monetary value of workdays lost to the illness. It can be observed that estimates of workdays lost to an episode of malaria are highest in the North-West and North-East regions. Persons with malaria in the North-West and North-East lose an average of seven workdays to malaria while their caregivers lose about five and six workdays respectively. Daily income loss for malaria patients and caregivers in the North-West are about ₦ 4, 041.95 and ₦ 2, 019.93 respectively. In the North-East, daily income loss for malaria patients and their caregivers correspondingly amounts to about ₦ 6, 411.35 and ₦ 3, 847.33 per person. Average productivity loss by malaria patients and caregivers in the North-West and North-East zones are approximately, ₦ 40, 157.20 and ₦ 64, 411.50 respectively.

Persons with malaria residing in the South-South and South West lose the next highest workdays to malaria. Individuals in this zone lose an average of six workdays to an episode of malaria. Caregivers in the South-South and South-West lose six and five workdays respectively. Mean daily income loss to malaria in terms of the patient and caregivers in the South-South are about ₦ 7, 105.48 and ₦ 5, 146.53 respectively. Malaria patients and their caregivers in the South-West correspondingly lose about ₦ 5, 649.58 and ₦ 5, 055.74 per day to a bout of malaria. Overall, South-South and South-West dwellers respectively experience mean productivity loss of approximately ₦ 73, 903.10 and ₦ 62, 795.10 to an episode of malaria.

Individuals in the North-Central and South-East, lose approximately the same number of workdays to malaria. Persons with malaria in these zones along with their caregivers, lose about five workdays to a bout of the illness. Mean daily income loss to a bout of malaria for patients and caregivers in the North-Central are about ₦ 4, 819.37 and ₦ 5, 086.58 respectively. Average daily income loss by patients and caregivers in the South-East are approximately ₦ 7, 451.81 and ₦ 2, 932.53 respectively. Average productivity loss by malaria patients and caregivers in the North-Central and South-East zones are about ₦ 45, 952.20 and ₦ 51, 512.40 respectively.

Findings across geopolitical zones indicate that workdays lost to malaria are although highest in the North-West and North-East, indirect cost associated with the illness is highest in the South-South part of the country. The higher work days lost to the illness

for persons who live in the North-West and North-East can be related to possible delay in treatment of the illness until severity sets in. This possible behaviour is in relation with low literacy rate among northern dwellers. This reduces quick attention and medication during illness. The result suggests that malaria induces relatively higher loss in labour contribution to economic output in the South-South region. This finding is expected given that the South-South is associated with the highest prevalence of malaria in Nigeria.

5.8 Direct Costs for Treatment of an Episode of Malaria

Direct costs[46] for the treatment of malaria are calculated as a sum of out-of-pocket spending on consultation, transportation to the hospital, drug and hospitalisation. Computations of direct costs are also presented as a fraction of monthly income. As previously done in this study, results of direct costs associated with malaria treatment are presented in three sub-tables. These are Tables 5.8a, b and c. Table 5.8a shows direct cost computations for the employment groups; Table 5.8 b indicates direct cost figures for place of residence, gender and income groups while Table 5.8c presents the results of direct cost computations for the geopolitical zones in the country. The tables also show the proportion of monthly income spent on an episode of malaria in Nigeria.

5.8.1 Direct Costs for Treatment of an episode of Malaria across Employment Types

Across the different employment groupings in the study, are variations in costs incurred for treating malaria. Results for malaria treatment across employment categories are shown in Table 5.8a. The figures indicate that individuals' in Nigeria spend an average of about ₦ 2, 730.46 as total expenditure for treatment of one bout of malaria. Further examination of direct cost figures reveals slight differences in treatment cost incurred by formal and informal sector workers. The figures show that persons employed in the informal sector spend about ₦ 2, 652.66 as total direct cost for treating malaria. On the other hand, those who are employed in the formal sector incur mean treatment cost of about ₦ 2, 601.52. The result therefore suggests slightly higher cost burden of about ₦51.14 for individuals in the informal sector than those in formal sector. Although differences in cost incurred are minimal, high prevalence of

[46] Direct cost estimates represent individual cost incurred for treatment of malaria. Mean estimates of direct costs are reported in Table 5.17.

poverty among informal sector workers implies that malaria induces higher reduction in welfare for informal sector workers relative to formal sector employees.

Table 5.8a Direct Cost Estimates (Treatment costs) for Malaria across Employment Types

Level/Label	Estimates of Direct cost (₦)	% of Monthly income
All	2,730.46*** (32.35)	3.14*** (13.85)
Employment Type		
Informal	2,652.66*** (31.85)	3.02*** (13.22)
Formal	2,601.52*** (14.10)	3.22*** (5.06)
Informal/Formal		
Wage employment	2,590.43*** (14.37)	3.17*** (5.12)
Informal		
Self-employment in Agriculture	2,852.17*** (24.92)	3.10*** (15.56)
Other Self Employment (Owned account)	2,264.72*** (24.14)	2.54*** (5.60)

Source: Author's computation

Notes:

1. Mean coefficient reported with t- values in bracket.
2. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels respectively
3. Level of statistical significance was based on conventional tabular t-values of 1.65 at 10%.,1.96 at 5% and 2.58 at 1%,

Direct cost estimates for malaria across employment groupings shows that individuals in self-agricultural employment spend highest for treatment of a bout of malaria than those in other work types. Persons in self-agricultural employment spend about ₦ 2, 852.17 for malaria treatment while those in wage and other self-employment spend approximately ₦ 2, 590.43 and ₦ 2, 264.72 respectively. The relatively high spending by self-agricultural workers for malaria treatment possibly relates with neglect of the illness till it becomes severe before seeking medical treatment. This is because agricultural activities are practised mainly in the rural areas where literacy level is expectedly low. The result suggests higher unfavourable welfare effects of malaria on self-agricultural sector workers than persons in wage and other self-employment.

In terms of income fraction spent on malaria treatment, the results show that individuals spend approximately 3% of monthly income for the treatment of a bout of malaria. The fraction of income spent on treatment is approximately equal for all persons regardless of work type.

5.8.2 Direct Costs for Treatment of an Episode of Malaria across Place of Residence, Gender and Income Groups

Treatment cost figures for an episode of malaria and monthly income fraction lost to the illness varies across gender, place of residence and income groups. Table 5.9b shows mean computations of direct cost for treatment of a bout of malaria across place of residence, gender and income groups.

Results for place of residence shows relatively higher spending by rural persons on malaria treatment than urban dwellers. This difference is reflected in the proportion of monthly income spent on treatment by rural and urban dwellers. The results show that urban dwellers spend about ₦ 2, 645.66 for treating an episode of malaria while rural persons spend approximately ₦ 2, 762.53. These figures translates to approximately 3.35% monthly income fraction spent for treating malaria by persons in the rural areas and 2.66% monthly income fraction spent on malaria treatment by urban dwellers. Cost burden of malaria is hence higher for rural than urban populace. This implies higher welfare reduction by rural than urban individuals in treating malaria.

Table 5.8b Direct Cost Estimates (Treatment costs) for Malaria across Place of Residence, Gender and Income Groups

Level/Label	Estimates of Direct Cost (₦)	Direct cost as a % of Monthly Income
Place of Residence		
Urban	2,645.66*** (16.49)	2.66*** (7.64)
Rural	2,762.53*** (27.83)	3.35*** (11.64)
Gender		
Male	3,150.33*** (20.35)	3.28*** (14.75)
Female	2,419.94*** (26.44)	2.78*** (4.82)
Income groups		
Poor	1391.95*** (6.17)	3.91*** (6.84)
Non poor	2817.98*** (31.82)	2.81*** (13.38)

Source: Author's computation

Notes:

1. Mean coefficient reported with t- values in bracket.
2. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels respectively
3. Level of statistical significance was based on conventional Tabular T-values of 1.65 at 10%.,1.96 at 5% and 2.58 at 1%,

Expenditure for treating an episode of malaria is also shown to be higher for males than females. This can be attributed to the fact that males continue in economic activity even while ill due to societal demands to make ends meet. They commonly neglect benefit of time to recuperate from illness and may some-times disregard completion of the treatment dose. This attitude reduces the efficiency of drug taken and requires repetition of treatment. The results show that males spend approximately ₦ 3, 150.33 on the average, for treatment of one episode of malaria. Females on the other hand, spend about ₦ 2, 419.94. This corresponds to about 3.28% of monthly income payments for males and 2.78% of monthly income earnings of females.

The results also show that poor persons spend relatively smaller amounts on malaria treatment compared to those who are non-poor. However, larger percentage of poor person's monthly income was expended on treating the illness than that of non-poor individuals. The results show that individuals who are poor spend about ₦ 1, 391.95 for treating one bout of malaria. Non-poor persons on the other hand spend approximately ₦ 2, 817.98 as treatment cost for an episode of malaria. These figures translate to about 3.91% monthly income of poor individuals and 2.81% income of non-poor persons. The relatively smaller amounts spent on malaria treatment by poor persons can be an indication of inability to afford proper treatment for the illness. This finding is an indication that malaria worsens poverty incidence in Nigeria because of higher treatment cost burden on persons who are poor than those who are non-poor.

5.8.3 Direct Costs for Treatment of an Episode of Malaria across Geopolitical Zones

Results for treatment cost spent on one bout of malaria for the six geopolitical zones are presented in Table 5.8c. The results are presented for the North-Central, North-East, North-West, South-East, South-South and South-West zones. The table also shows the findings on income fraction lost to malaria across the geopolitical zones.

An examination of treatment costs across the geopolitical zones shows higher treatment expenditure for some of the zones than others. The results reveal that persons who reside in the North-West spend the highest amounts for treatment compared to the other zones. Individuals who reside in the South-East spend the next highest amount for treating an episode of malaria. This is followed by South-West, North-East and North-Central residents. Average estimates of direct cost for treatment of an episode

of malaria are shown to be about ₦ 3, 020.68 for persons who live in the North-West and ₦ 2, 927.45 for individuals who reside in the South-East. Mean figures for direct costs is approximately ₦ 2,681.11 for South-West persons and ₦ 2,635.18 for North-East residents. Individuals in the South-South and North-Central zones spend average amounts of about ₦ 2, 582.08 and ₦ 2, 139, 98 respectively for treating one bout of the illness. It is likely that zones with higher treatment cost for malaria have residents with low literacy rate and exhibits attitudes of neglect of illness unless it initiates some disability conditions. The result suggests lowest treatment costs for malaria in the North-Central zone. This can be explained by low prevalence of malaria in this zone due to low malaria vector (mosquitoes). The North-Central zone are mainly highlands and do not encourage breeding sites for mosquitoes.

Table 5.8c Direct Cost Estimates (Treatment costs) due to Malaria across Geopolitical Zones

Level/Label	Estimates of Direct Cost (₦)	% of Monthly Income
North-Central	2139.98*** (8.44)	3.39*** (3.48)
North-East	2635.18*** (10.15)	5.06*** (5.88)
North-West	3020.68*** (13.73)	4.06*** (10.03)
South-East	2927.45*** (16.66)	3.50*** (3.79)
South-South	2582.08*** (16.90)	2.62*** (8.17)
South-West	2681.11*** (13.29)	2.12*** (7.98)

Source: Author's computation

Notes:

1. Mean coefficient reported with t- values in bracket..
2. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels respectively
3. Level of statistical significance was based on conventional Tabular T-values of 1.65 at 10%.,1.96 at 5% and 2.58 at 1%,

Although amounts spent on malaria treatment is relatively higher in the North-West and South-East zones, the fraction of income spent on treatment is highest for individuals in the North-East. This is an indication that North-East dwellers have higher poverty risk from malaria. The North-West and South-East zones follow the North-East in terms of relatively higher income fraction spent on malaria treatment. Persons in the North-Central spend the next highest monthly income fraction while Individuals in the South-West zone have the smallest percentage of monthly income spent on malaria treatment. The results show that individuals in the North-East spend as much as 5.06% of monthly income on treatment of a bout of malaria. Those in the North-West spend about 4.06% of monthly income while South-East and North-Central individuals spend approximately 3.50% and 3.39% of monthly income respectively on an episode of the illness. Individuals in the South-South and South-West spend 2.62% and 2.12% of monthly income respectively, for a bout of malaria.

The result suggests that individuals in the northern part of Nigeria experience higher scourge from malaria than those in the south. Persons in the north generally bare higher treatment cost burden from malaria than those in the south. The effect is higher specifically for the North-East and North-West zones.

5.9 Cost Estimates as a Fraction of GDP

Total cost as a fraction of GDP is examined by summation of total direct and indirect costs and determining its fraction in GDP. For simplicity, this study determined total costs associated with malaria assuming all persons in the economy experienced an episode of the illness in a year. Total direct costs were determined as a product of mean direct cost figures and total Nigerian population in 2009. Population figures for 2009 were used because the HNLSS data was drawn during this period.

To compute total indirect cost, the study first determined the percentage of the economically active population from the Nigerian populace in 2009. This was done using percentage value of the economically active population from the HNLSS. With study finding that one in two individuals in the economically active population will experience productivity loss from malaria, the study made use of half of the economically active population value in 2009 to determine total productivity loss for malaria patients. Similarly, total productivity loss for the caregiver was computed

using percentage of the economically active population who were caregivers for malaria as obtained from the study data. The study thus determined total productivity loss from malaria patients by multiplication of mean productivity loss with half of the economically active population in 2009. Total productivity loss for the caregiver was similarly obtained as the product of average productivity loss and the fraction of the economically active population in 2009 that are caregivers. Total productivity loss associated with one episode of malaria for the entire populace was computed as the summation of total productivity loss from malaria patients and the caregivers.

Figures for total costs in relation to one occurrence of malaria in Nigeria were computed as the sum of total direct and indirect costs for the Nigerian population in 2009[47]. The study examined economic loss to malaria in Nigeria by determining fraction of total costs in GDP[48] for 2009. This provided a measure of what the economy would have gained if there were zero incidence of malaria in the country. The results are presented in Tables 5.9a, b and c. Table 5.9a shows the results of total costs associated with malaria and percentage of costs in GDP across employment types, while Table 5.9b presents these results across place of residence, gender and income groups. Table 5.9c reveals the findings by geopolitical zones.

5.9.1 Total Cost Associated with Malaria and Cost Fraction in GDP across Employment Types.

There are indications of disproportionate amounts of total costs associated with malaria and GDP losses to the illness for different employment types in Nigeria. Table 5.9a presents findings for total costs associated with malaria and cost fraction in GDP for employment types. Findings at the national level shows that total indirect and direct costs associated with one occurrence of malaria are ₦ 1,481.80 and ₦ 420.49 billion

[47] This study made use of 2009 working population figures. Estimates of population for the different levels were derived from equivalent percentage composition of each level in HNLSS represented in the 2009 Nigerian working population. Percentage distribution of persons having malaria across levels (Table 5.1) was used for determining each level population for direct cost. Hence, direct cost was estimated using individuals for all age groups. Indirect cost was estimated only for persons in the economically active population. The study determined the population size of the economically active population assuming all persons in this group had one episode of malaria in 2009; half of these persons will miss workdays. Hence, productivity loss was determined for half of the working population. See appendix for details on cost estimation.

[48] GDP and national population figures for 2009 were sourced from NBS (2012). GDP current market value of ₦ 25, 225.1 billion for 2009 was used in this study. Current market value figure of GDP was used basically due to cost estimation in HNLSS at current prices.

respectively. This result suggests higher losses in labour contribution to output than treatment expenditure. Summation of total indirect and direct costs shows that the economy loses about ₦ 1,906.08 billion to malaria attack per year. This figure represents about 7.56% of GDP loss to a bout of malaria. An earlier study by Alaba and Alaba (2009) showed about 10% of GDP lost to the illness in Oyo State. The result however, shows that the economy still loses substantial amounts to malaria.

The result further reveals higher fraction of GDP lost from the informal than formal sector. The result shows that the informal sector has associated total indirect and direct cost of about ₦ 1,440.10 and ₦ 384.64 billion respectively. These sums up to a total cost figure of about ₦ 1,824.73 billion and represent about 7.23% of GDP lost to malaria from the informal sector. In the formal sector, total indirect and direct costs from malaria are about ₦ 82.60 and ₦ 25.21 billion respectively. Total cost associated with malaria in the formal sector is approximately ₦ 107.80 billion. The implication is that about 0.43% of GDP is lost to malaria with reference to the formal sector.

Table 5.9a Direct and Indirect Cost Estimates (₦ billion) as a Fraction of 2009 GDP (Employment Types)

Level/Label	Total Indirect Cost of Patient	Total Indirect of Cost Caregivers	Total Indirect Cost	Total Direct Cost	Total Cost (Direct and Indirect)	Total Cost % of GDP
All	1,481.80	3.79	1485.59	420.49	1,906.08	7.56
Employment Types						
Informal	1,436.63	3.47	1440.10	384.64	1,824.73	7.23
Formal	82.27	0.33	82.60	25.21	107.81	0.43
Formal /Informal						
Wage employment	108.10	0.33	108.43	32.85	141.28	0.56
Informal						
Self-employment in agriculture	697.97	1.31	699.28	214.65	913.92	3.62
Other self-employment (Owned account)	732.20	2.00	734.20	150.24	884.44	3.51

Source: Author's computation

It is further shown that GDP lost to malaria in Nigeria is higher for self-employment in agriculture than other self-employment types and wage employment. This result suggests that the Nigerian economy will gain sufficiently from agricultural sector production with eradication of the illness. The figures show that total indirect and direct costs from malaria in self-agricultural sector employment are about ₦ 699.28 and ₦ 214.65 billion respectively. This implies a total cost figure of about ₦ 93.92 billion and represents approximately 3.6% of GDP.

Total indirect and direct costs from malaria for other self-employments grouping is shown as approximately ₦ 734.20 and ₦ N150.24 billion respectively. Summation of total indirect and direct cost for other self-employment types yields overall cost value of approximately ₦ 884.44 billion. This corresponds to about 3.51% of GDP lost to malaria from other self-employment.

Values of total indirect and direct costs from malaria for wage employment are approximately ₦ 108.43 and ₦ 32.85 billion respectively. This indicates total cost value of about ₦ 141.28 billion and represents approximately 0.56% of GDP.

5.9.2 Total Cost Associated with Malaria and Cost Fraction in GDP across Place of Residence, Gender and Income Group.

Table 5.9b shows the results of total costs associated with one episode of malaria in Nigeria across place of residence, gender and income groups. Examination of total cost effect of malaria suggests that the economy experiences higher loss from malaria attack in the urban than rural areas. The figures indicate that total indirect and direct cost from malaria for urban areas are about ₦ 1,112.91 and ₦ 296.31 billion respectively. This sums up to about ₦ 1410.10 billion. The figures indicate that about 5.59% of GDP is lost to malaria from the urban areas. In the rural areas, total indirect and direct costs from malaria are shown as approximately ₦ 402.19 and ₦ 116.95 billion respectively. This amounts to total costs value of about ₦ 519.13 billion. The result suggests that approximately 2.06% of GDP is lost to malaria in the rural areas.

Table 5.9b Direct and Indirect Cost Estimates (₦ billion) as a Fraction of 2009 GDP (Place of Residence, Gender and Income Group)

Level/Label	Total Indirect Cost of Patients	Total Indirect Cost of Caregivers	Total Indirect Costs	Total Direct Cost	Total Cost (Direct and Indirect)	Total Cost % of GDP
Place of Residence						
Urban	1,112.91	0.88	1,113.79	296.31	1410.10	5.59
Rural	399.22	2.97	402.19	116.95	519.13	2.06
Gender						
Male	617.04	1.52	618.56	206.61	825.16	3.27
Female	821.52	3.08	824.60	214.64	1039.23	4.12
Income Group						
Poor	22.33	0.04	22.37	13.19	35.55	0.14
Non-poor	1,838.66	4.93	1,843.59	408.61	2252.20	8.93

Source: Author's computation

The results also signify that economic loss to malaria in Nigeria is higher for females than males. This is an indication that the economy will benefit more from female contribution to output with eradiation of malaria in Nigeria. The figures show that total indirect and direct cost from one episode of malaria for females are about ₦ 824.60 and ₦ 214.64 billion respectively. This sum up to an overall cost figure of about N 1,039.23 billion and represents approximately 4.12% of GDP. Figures of total indirect and direct cost from males ill with malaria are approximately ₦ 618.56 and ₦ 206.61 billion respectively. This adds up to total costs of about ₦ 825.16 billion and corresponds to approximately 3.27% of GDP.

The findings further suggest that there are more economic losses to malaria from persons who are non-poor than those who are poor. Total indirect and direct costs figures for non-poor persons are shown as ₦ 1,843.59 and ₦ 408.61 billion respectively. This sums up to total cost value of about ₦ 2,252.20 billion. The result implies that about 8.93% of GDP is lost with reference to non-poor persons. Total indirect and direct cost estimates from malaria for poor persons are approximately ₦ 22.37 and ₦ 13.19 billion respectively. This amounted to approximately ₦ 35.55 billion as total cost value for poor persons with malaria. This figure represents about 0.14% of GDP lost to the illness.

5.9.3 Total Cost Associated with Malaria and Cost Fraction in GDP across Geopolitical Zones

Analysis of total costs in relation to malaria across the geopolitical zones shows that economic loss to malaria is highest from the south than other parts of the country. Only one of the zones in the north specifically the North-West has relatively higher total cost burden from the illness. Figures for total cost computations for malaria across the geopolitical zones are presented in table 5.9c.

Table 5.9c Direct and Indirect Cost Estimates (₦ billion) as a Fraction of 2009 GDP (Geopolitical Zones)

Level/Label	Total Indirect Cost for Patients	Total Indirect Cost for Caregivers	Total Indirect Costs	Total Direct Cost	Total Cost (Direct and Indirect)	Total Cost % of GDP
North-Central	81.72	0.56	82.28	26.71	108.99	0.43
North-East	168.60	0.53	169.13	37.69	206.81	0.82
North-West	287.56	0.42	287.98	105.32	393.30	1.56
South-East	303.92	0.24	304.16	82.47	386.62	1.53
South-South	326.14	0.97	327.11	97.80	424.91	1.68
South-West	269.43	0.58	270.01	71.31	341.32	1.35

Source: Author's computation

The results show that total indirect and direct cost figures for malaria from the South-South are about ₦ 327.11and ₦ 97.80 billion respectively. This implies total costs value of approximately ₦ 424.91 billion and represents about 1.68% of GDP.

The North-West follows the South-South in relation to economic losses from malaria in Nigeria. The results show that about ₦ 287.98 and ₦ 105.32 billion are indirect and direct cost figures respectively for the North-West. This indicates total cost value of approximately ₦ 393.30 billion and is equivalent to about 1.56% of GDP.

The South- East is shown as the next region with relatively high monetary loss from malaria after the North-West zone. Total indirect and direct costs associated with malaria in the South-East are about ₦ 304.16 and ₦ 82.47 billion respectively. This sums up to approximately ₦ 386.62 billion and represents about 1.53% of GDP.

The South-West zone follows next after the South-East in contributing to economic loss from malaria in Nigeria. The results indicate that the South-West experiences total indirect and direct costs from malaria of about ₦ 270.01 and ₦ 71.31 billion respectively. This is equivalent to about ₦ 341.32 billion as total cost from an episode of malaria. This figure represents about 1.35% of GDP lost to the illness.

Figures for cost associated with malaria in the North-East indicate that total indirect and direct costs from malaria are about ₦ 169.13 and ₦ 37.69 billion respectively. Total costs attributable to malaria in the region amounts to approximately ₦ 206.81 billion. This indicates about 0.82% of GDP. The figures suggest that the zone follows next after the South-West in malaria contribution to economic loss in Nigeria.

The North-Central reflects least monetary loss to malaria in Nigeria. The figures show that total indirect and direct cost to malaria in the zone are approximately ₦ 82.28 and ₦ 26.71 billion respectively. This indicates a total sum of ₦ 108.99 billion as total cost from malaria in the zone. It further implies that about 0.43% of GDP is lost to the illness with reference to the North-Central zone.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATION

6.1 Introduction

This chapter provides a summary of the major findings of the study. Based on these findings, relevant conclusions are drawn on malaria effect on labour employment and cost implication of the illness in Nigeria. The chapter also presents recommendations for policy actions, limitations to the study and areas that can be explored for further research.

6.2 Summary

African economies are generally weighed down with heavy illness burden particularly in relation to communicable diseases. Malaria is one of such illness that constitutes a huge burden in the region due to its persistent high prevalence. This is in spite of policy actions to reduce incidence of the illness through campaigns and use of treated mosquito nets.

Current figures show that the Nigerian economy still has the highest number of reported cases of malaria in the world. In such economy where there are pervasive cases of drug resistant malaria parasites along with high poverty rates, it is important to explore implications of the illness on labour employment probability and cost associated with at least one bout of the illness. This situation has motivated investigation of the effect of malaria on employment probability and associated cost burden of the illness in Nigeria.

To achieve this objective, the study made use of data from the Harmonised Nigerian Living Standard Survey (HNLSS). Probit and instrumental variable probit models were used to estimate the relationship between malaria and labour employment in Nigeria. Computations of cost associated with malaria were determined for direct and

indirect costs using the BUA and HCA, respectively. Cost implications were also presented as a fraction of monthly income earnings and GDP. The results were shown in six levels; national, employment types; place of residence, gender, income groups and across the six geopolitical zones.

The findings provide empirical support to hazardous effect of malaria in the Nigerian economy. Study findings also offer policy makers information on how much malaria hampers economic progress and hence seek measures for eradicating the illness. Major findings derived from the study are presented below:

Findings on labour employment show that malaria has detrimental effects on labour engagement in economic activity in Nigeria. Negative effects of malaria on employment probability were observed across all levels of analysis considered in the study. The only exceptions were the North-Central and South-West zones. The effect of malaria on employment probability conforms to earlier findings on the effect of poor health conditions on labour market outcomes (Stern, 1989; Gannon and Nolan, 2003; Cai and Kalb, 2004; Bridges and Lawson, 2008; Levinsohn *et al* 2011; Machio, 2012). The results further suggest that high prevalence of malaria in Nigeria has negative implications on earning ability and welfare conditions.

Findings also suggest that the illness is responsible for huge losses in labour contribution to economic output in Nigeria. One in two individuals in the economically active population will experience losses in labour contribution to output while ill with malaria. Such individuals and their caregivers will on the average experience six and five workdays lost respectively to an episode of the illness. Summation of monetary values of workdays lost by the patient and the caregiver implies average productivity loss of approximately ₦ 59, 586.70. Extrapolation of the result to the entire economically active population in the country suggests that the Nigerian economy lose labour contribution of about ₦ 1,485.59 billion to one occurrence of the illness per year.

The results further suggest that malaria increases poverty risks in Nigeria particularly for persons in self-employment. Mean figures for workdays lost from the illness was shown to be higher for individuals in self-employment than those in wage work. Unlike wage workers, the illness reduces income prospects for self-employed persons

who would have to be present at work and perform required job functions to earn income. Similarly, the illness increases vulnerability of rural persons to poverty than urban dwellers. This follows from the higher workdays lost to the illness by rural than urban individuals.

In examining direct costs related to malaria, individuals spend approximately ₦ 2, 730 on the average for treatment of the illness. Amounts spent on malaria treatment were not significantly different for formal and informal sector workers. However individuals in self-agricultural employment spend more for treating the illness than those in wage and other self-employment types. This can be associated with the fact that persons in agricultural self-employment are most likely in the group of those with no formal or low educational attainment and hence will not give proper attention to treatment of malaria until it becomes severe. This also explains findings for higher treatment costs for persons who live in the rural areas than those in the urban areas. Females were also found to spend more as curative expenditure for malaria than males. Individuals from non-poor household also incurred higher treatment cost for malaria than those from poor households. Across geopolitical zones, amount spent treating malaria was relatively higher for the North-West and South-East than other zones in the country.

The result of direct cost estimates associated with malaria in Nigeria further suggests that on the average, about 3% of monthly income earning is lost as treatment cost for one episode of the illness. Persons who are poor lost as much as 4% of monthly income to the illness. This result suggests that malaria has some unfavourable influence on policy actions geared towards reducing income inequality in the country. The results reveal that those who reside in the North-East spend higher income fraction for malaria treatment than any other zones in the country.

Findings from the study further imply an overall of ₦1, 906.08 billion as total direct and indirect cost associated with one episode of malaria in Nigeria. The implication is that the Nigerian economy lost approximately 8% of GDP to one bout of malaria each year. This result is in close approximation to an earlier finding by Alaba and Alaba (2009) on the cost implication of malaria on GDP in Nigeria.

The results further suggest that the fraction of GDP lost to malaria in Nigeria is higher in the informal than formal sector. This is particularly with reference to self-

employment in agriculture. This is an indication that agricultural sector contribution to economic output is the most affected by malaria prevalence in Nigeria. It provides support to the argument that malaria reduces agricultural output in an economy. Agricultural production in Nigeria can therefore be significantly improved with effective malaria control programmes.

GDP loss to malaria were also relatively higher for males than females, urban than rural areas and non-poor than poor persons. Zone specific figures show that GDP loss to malaria in Nigeria is relatively higher from the South-South and North-West than other zones.

Findings of the study in relation to other determinants of labour employment decisions, suggest that having higher educational attainment does not necessarily increase labour participation in Nigeria. Educated persons were found to engage more in formal than informal sector employment. The highly informal nature of the Nigerian economy deters absorption of educated persons in the workforce. Thus, individuals who have higher educational attainment in Nigeria do not have better chances of being gainfully employed than those who are not educated.

The result also suggests that increase in labour income has positive effects on the decision to participate in the labour force. Other findings indicate that an individual's place of residence essentially influences the choice to participate in the labour force. Persons who reside in the urban areas would participate more in the labour force than those in the rural areas. An individual's gender also determines the decision to participate in the Nigerian labour force. The results suggest that the probability of labour employment in Nigeria is higher for females than males.

Findings from the study suggest that living with young children aged 0 to 4 years does not explain the probability of labour employment in Nigeria except for individuals from poor households. Living with children aged 0 to 4 year's increases the choice of labour force participation for persons grouped as poor in the country. On the other hand, living with children aged 5 to 9 years generally has significant positive effects on the likelihood of labour participation decisions. This result conforms to earlier findings particularly for developing economies (Smith, 1981; Aminu, 2010).

6.3 Conclusions

This study examined the effect of malaria in the Nigerian economy in relation to labour employment probability and estimated the associated cost burden.

The findings show a negative and statistically significant relationship between malaria and Labour employment in Nigeria. The effect is higher for informal than formal sector employment, females than males, persons who are non-poor than those that are poor and highest in the South-South part of the country. Effect of the illness on labour employment probability is approximately equal for urban and rural residents. Significant effects of malaria on labour employment probability does not exist in the North-Central and South-West zones. In the case of direct cost, significant proportion of monthly income is lost to an episode of malaria in Nigeria with higher income losses to treatment from persons who are poor and those who reside in the North-East and North-West. The economy loses substantial amounts as indirect costs or otherwise productivity losses to a bout of malaria. Losses in labour productivity in relation to the illness are higher from informal employment, urban areas and the South-South. Indications of GDP loss to malaria show that prevalence of the illness hampers opportunities for economic advancement in the country. The economy loses more to the illness from informal employment especially agricultural sector production than other employment types. Conclusions derived from the study basically underscore the argument that malaria is essentially hazardous to welfare advancement and economic performance in Nigeria.

6.4 Recommendations

Premised on the findings of the relationship between malaria and labour employment as well as cost implications of the illness, it is pertinent to provide lessons for policy actions. This is with the intent to increase labour employment and hence, improve welfare of the Nigerian populace.

The negative effect of malaria on labour employment in Nigeria unequivocally explains its role in determining the proportion of persons in the Nigerian labour force

engaged in productive activities. A sure way therefore to increase labour employment in the country and enhance wellbeing of the Nigerian populace is to ensure continuous implementation of policy actions that will significantly reduce malaria prevalence or initiate complete eradication of the illness. Public enlightenment campaigns on the use of treated mosquito bed-nets and keeping clean environments should be adequately emphasised in both urban and rural areas. This policy action should be concentrated in rural and urban areas with intense focus in the South-South where negative effects of malaria on labour participation decision are highest.

In addition, conclusions on direct cost implication of malaria in Nigeria signify that policy actions targeted at effective control of the illness will undoubtedly enhance prospects for individual and household allocations to basic needs and hence improve living standards. Such policy actions will further curb the extent of malaria effect on expansion of the income gap between the rich and the poor. Adequate distribution of highly subsidized insecticides and insecticide treated bed-nets are other policy actions that can abate prevalence and economic losses to the illness in the country. Strategy actions such as provision of subsidized malaria drug should continuously be embarked upon to reduce the cost burden of the illness particularly on the poor. Such actions should be intensified in the rural areas, North-East and North-West where there are records of higher income loses to treatment of the illness.

Provision and use of mosquito treated nets, insecticides and malaria drugs should also be targeted on persons engaged in agricultural activity. This will ameliorate prevalence and negative effect of the illness on productivity of agricultural sector workers as well as raise income prospects for individuals in agricultural self-employment. Such policy action will also enhance output through increase in agricultural sector contribution to GDP.

In line with findings of reduced chance of labour employment with increase in educational attainment, government efforts to promote employment should focus on advancement in provision of formal work types. This is to enable absorption of the teeming population of educated persons in the country.

Sequel to findings on increase in labour employment probability with a rise in income, labour engagement in economic activity and contribution to output can be enhanced by

introduction of strategies that raise income prospects. Tactic actions that initiates income increase such as policies which induce reduction in production cost, increase availability and access to credit as well as low interest charges on loans will motivate labour participation decisions and hence raise economic output.

Overall, effective malaria control programmes are invaluable to attaining welfare improvement, increase labour force participation and achieve output expansion in Nigeria.

6.5 Study Limitations

This study provided invaluable empirical findings on the effect of malaria in the Nigerian economy. Nonetheless, the study had some limitations that forestalled deeper insights to the impact of the illness in the country. These constraints are highlighted below.

The data used for the study was obtained using respondents' information for two weeks. This sets a limit to the amount of information obtained during the study.

The inability to obtain data on preventive care expenditure related to malaria hindered establishing the relationship between preventive care expenditure on malaria and labour employment probability. Data on preventive care such as the amount spent on purchase of insecticides and mosquito treated nets would have enabled examination of the unit cost effect of preventive care expenditure on malaria prevalence in Nigeria. An extension of this result would have enabled the determination of effects of preventive care expenditure on labour employment decisions in Nigeria.

Another limitation of this study relates to inadequate information on health insurance scheme in Nigeria. Lack of information on public and private health insurance coverage prevented inclusion of insurance payments in computation of out-of-pocket expenditure for malaria treatment. Such information would have provided insights to whether insurance payments significantly reduce cost burden associated with malaria in Nigeria.

Lastly, lack of information in relation to labour substitution in terms of hired labour and household replacement of sick individual in labour activities deterred examination of hired labour effects on productivity losses from malaria. Such information would

have been necessary to determine whether labour substitution significantly reduces productivity loss from malaria.

6.6 Suggestions for Future Research

Sequel to the study's limitations, it is expected that future research can extend the findings of this study to include preventive care costs effect on malaria prevalence in Nigeria. Such studies can further provide insight on the relationship between preventive care expenditure on malaria and labour market outcome in Nigeria. In addition, disaggregation of preventive care into various categories will establish most effective preventive care measure for malaria in Nigeria.

Another grey area of further research relates to examining the significance of health insurance in reducing cost burden associated with malaria in Nigeria. Findings from such study will provide policy makers with information that drives strategic policy actions to increase health insurance coverage in Nigeria.

Future research can also include labour substitution in determining the extent of productivity loss from malaria. Findings from such study will indicate whether labour substitution significantly reduces productivity losses from malaria in Nigeria.

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APENDIX

APENDIX A Probit Regression Results

Table A1:1 First stage Probit Regression results

	NATIONAL	**PLACE OF RESIDENCE**		**GENDER**	
VARIABLE	ALL LEVELS	URBAN	RURAL	MALE	FEMALE
Logincome	0.0226(13.79)***	0.02(7.44)***	0.0239(11.66)***	0.0201(12.66)***	0.0455(5.27)***
Prim_Educ	0.0129(2.14)**	0.006(0.53)	0.0155(2.23)**	0.0075(1.17)	0.0328(1.57)
Sec_Educ	0.0002(0.03)	-0.0101(-0.95)	0.0048(0.68)	-0.0012(-0.2)	0.0039(0.17)
Tert_Educ	0.0003(0.04)	-0.0136(-1.3)	0.0108(1.3)	-0.0001(-0.02)	-0.0067(-0.28)
Gend_male	-0.047(-8.99)***	-0.0299(-3.88)***	-0.0578(-8.28)***	Omitted()	Ommitted()
Age	-0.0028(-2.76)***	-0.0053(-3.25)***	-0.0013(-1.02)	-0.0043(-4.18)***	0.0064(1.49)
Agesquared	0(3.45)***	0.0001(3.49)***	0(1.69)*	0.0001(4.7)***	-0.0001(-1.1)
Urban	-0.0069(-2.04)**	-0.0029(-0.79)	0.0028(1.11)	-0.0051(-1.5)	-0.0202(-1.4)
kids0004	0.0008(0.39)	0.0055(1.43)	-0.0012(-0.44)	0.0023(1.14)	-0.009(-0.79)
kids0509	0.0008(0.36)	0.0046(1.84)*	0.0046(3.12)***	0.0003(0.15)	0.0188(1.38)
INSTRUMENTS					
Dist_Food	0.0045(3.56)***	-0.0022(-0.92)	0.0049(3.4)***	0.004(3.18)***	0.0062(1.09)
Dist_health	0.0029(2.36)**	0.02(7.44)***	0.0239(11.66)***	0.0001(0.1)	0.0253(4.73)***
Observation	15,028	5,521	9,507	1,3191	1,837
LR chi^2	402.06	104.63	323.72	217.44	108.44
Psuedo R2	0.0696	0.0519	0.0861	0.0492	0.0857
DIAGNOSTIC TEST					
Joint Chi2 test for H_0: Coefficient on instrument (s)=0 (p-value in bracket)	35.40(0.0000)	3.38(0.0658)	41.75(0.0000)	10.11(0.0015)	22.35(0.0000)

Note: Marginal effects of coefficients are reported with Z-values in brackets. *, ** and *** indicates statistical significance at 10%, 5% and 1% levels respectively. Joint Chi square test on relevance of instrument was conducted on instrument(s) that are statistically significant in the first stage regression basically to determine whether instrument(s) used are weak or strong in explaining the probability of reporting malaria (endogenous variable)

Table A1:1 First Stage Probit Regression Results

	INCOME GROUPS		EMPLOYMENT TYPE		
VARIABLE	POOR HHD	NON POOR HHD	INFORMAL EMP	FORMAL EMP	WAGE EMP
Logincome	0.0234(6.12)***	0.0164(4.43)***	0.0229(12.31)***	0.0197(5.49)***	0.0203(5.63)***
Prim_Educ	0.0076(1.45)	0.0206(1.7)*	0.0102(1.65)*	0.0672(1.35)	0.0356(1.06)
Sec_Educ	-0.0025(-0.46)	0.0027(0.23)	-0.0016(-0.25)	0.0448(1.15)	0.0223(0.8)
Tert_Educ	0(0.01)	0.0002(0.01)	0.0074(0.95)	0.0245(0.82)	0.0097(0.4)
Gend_male	-0.035(-5.62)***	-0.0563(-6.46)***	-0.0558(-9.16)***	-0.0269(-2.2)**	-0.0298(-2.4)**
Age	-0.0015(-1.39)	-0.0039(-2.11)**	-0.0024(-2.12)**	-0.0021(-0.76)	-0.0017(-0.62)
Agesquared	0(1.87)*	0.0001(2.71)***	0(2.71)***	0(0.85)	0(0.71)
Urban	-0.0078(-2.28)**	-0.011(-1.76)*	-0.0067(-1.71)*	-0.0005(-0.06)	-0.0005(-0.06)
kids0004	0.0034(2.09)**	0.0019(0.39)	0.001(0.44)	-0.0018(-0.4)	-0.0011(-0.23)
kids0509	0.0027(1.5)	0.0009(0.18)	-0.0006(-0.22)	0.0072(1.46)	0.0075(1.54)
INSTRUMENTS					
Dist_Food	0.003(1.74)*	0.0003(0.59)	0.006(4.23)***	-0.0006(-0.19)	-0.0008(-0.27)
Dist_health	-0.0003(-0.19)	0.0001(1.73)*	0.0019(1.41)	0.0051(1.72)*	0.0054(1.82)*
Observation	7,858	7,170	11,792	2,552	2,637
LR chi^2	116.95	147.85	358.80	44.79	45.49
Psuedo R2	0.0643	0.0393	0.0776	0.0523	0.0508
DIAGNOSTIC TEST					
Joint Chi2 test for H_0: Coefficient on instrument (s)=0 (p-value in bracket)	152.40 (0.000)	23.79 (0.0800)	17.93(0.0000)	2.96(0.0852)	3.33(0.0680)

Table A1:2 First Stage Probit Regression Results

	EMPLOYMENT TYPE		GEOPOLITICALZONE		
VARIABLE	SELF AGRIC EMP	SELF OTHERS (OWNED ACCOUNT)	NORTH CENTRAL	NORTH EAST	NORTH WEST
Logincome	0.0228(9.82)***	0.0214(7.07)***	0.0095(3.98)***	0.0091(3.9)***	0.01(3.15)***
Prim_Educ*	0.0139(1.93)**	0.0014(0.13)	0.0024(0.22)	0.013(0.8)	0.0238(1.7)*
Sec_Educ*	0.0085(1.09)	-0.0177(-1.67)*	0.0001(0.01)	0.0129(0.88)	0.0091(0.7)
Tert_Educ*	0.0295(2.56)***	-0.0138(-1.24)	-0.0038(-0.37)	-0.0043(-0.3)	0.0094(0.66)
Gend_male*	-0.0741(-8.17)	-0.0344(-4.16)***	-0.0262(-2.51)***	-0.1013(-3.81)***	-0.2993(-7.84)***
Age	-0.0016(-1.09)*	-0.0035(-1.93)**	-0.0008(-0.5)	-0.0007(-0.28)	-0.0025(-1.15)
Agesquared	0(1.77)	0(1.98)**	0(0.79)	0(0.49)	0(1.3)
Urban*	-0.0058(-0.93)	-0.0093(-1.59)	0.0048(0.91)	0.0164(1.73)*	-0.0066(-0.93)
kids0004	-0.001(-0.34)	0.0045(1.14)	0.0046(1.7)*	-0.0039(-0.95)	0.0012(0.34)
kids0509	0.0016(0.51)	-0.0037(-0.85)	0.0007(0.22)	0.0078(2.09)**	-0.0015(-0.42)
INSTRUMENTS					
Dist_Food	0.0055(3.24)***	0.0066(2.73)***	0.0002(0.29)	0.0000(0.03)	0.0043(7.77)***
Dist_health	0.0033(2.02)**	-0.0011(-0.46)	-0.0023(-4.03)***	0.0017(2.46)**	0.0033(6.19)***
Observation	6,410	5,297	2,823	1,314	2,042
LR chi^2	284.37	103.44	29.13	53.06	182.60
Psuedo R2	0.1154	0.0488	0.0553	0.1644	0.2841
DIAGNOSTIC TEST					
Joint Chi2 test for H_0: Coefficient on instrument (s)=0	27.68(0.000)	7.45(0.0063)	16.24(0.001)	6.06(0.0139)	252.02(0.0000)

(p-value in bracket)					

Table A1:3 First Stage Probit Regression Results

VARIABLE	GEOPOLITICALZONE		
	SOUTH EAST	SOUTH- SOUTH	SOUTH- WEST
Logincome	0.0412(7.39)***	0.0301(5.56)***	0.0198(5.45)***
Prim_Educ*	-0.0126(-1.02)	0.0129(0.79)	0.0332(1.68)*
Sec_Educ*	-0.0144(-1.08)	-0.0044(-0.26)	0.0074(0.43)
Tert_Educ*	-0.0155(-1.08)	0.0325(1.64)	0.0058(0.31)
Gend_male*	-0.0324(-2.71)***	-0.0302(-2.52)***	-0.0251(-2.44)**
Age	-0.0038(-1.28)	-0.0031(-1.08)	-0.0063(-2.95)***
Agesquared	0.0001(1.77)*	0(1.13)	0.0001(3.03)***
Urban*	0.0101(0.98)	-0.0432(-4.22)***	-0.0117(-1.4)
kids0004	0.0005(0.07)	0.0118(2)**	-0.0013(-0.23)
kids0509	0.0064(0.94)	-0.0027(-0.4)	0.0036(0.62)
INSTRUMENTS			
Dist_Food	0.0038(3.11)**	0.0034(3.61)**	0.0039(4.13)***
Dist_health	0.0023(2.02)**	0.0012(1.30)	-0.0046(-4.71)**
Observation	2,232	3,278	3,339
LR chi^2	90.43	67.63	61.18
Psuedo R2	0.0869	0.0381	0.0463
DIAGNOSTIC TEST			
Joint Chi2 test for H_0: Coefficient on instrument (s)=0 (p-value in bracket)	28.57(0.0000)	13.06(0.0003)	25.78(0.0000)

APPENDIX B. Cost Estimates Associated with Malaria

TABLE B1. Direct Cost

Level/Description	Per individual Direct cost estimate	Sample size 2	Total Direct cost sample	Population size	Total Direct cost National
	1.00		3 = (1*2)	4	5=1*4
All	2730.46	5116.00	13969007.78	154000000.00	420490070000.00
Urban	2645.66	1404.00	3714503.83	112000000.00	296313696000.00
Rural	2762.53	3712.00	10254503.94	42333812.00	116948340996.74
Male	3150.33	2175.00	6851963.40	65583468.00	206609435577.50
Female	2419.94	2941.00	7117043.54	88694274.00	214634821423.56
Poor	1391.95	314.00	437071.99	9472653.00	13185449870.70
Non poor	2817.98	4802.00	13531935.16	145000000.00	408606955000.00
Informal employment	2652.66	4089.00	10846706.30	145000000.00	384634975000.00
Formal employment	2601.52	337.00	876711.57	9688642.00	25205176558.56
Wage employment	2590.43	1054.00	2730309.00	12681630.00	32850824074.38

Self-employment in agriculture	2852.17	2849.00	8125843.73	75256683.00	214645154578.84
Other self-employment (Owned account)	2264.72	2593.00	5872429.33	66339429.00	150240497002.60
North-Central	2139.98	414.00	885952.13	12481069.00	26709250519.69
North-East	2635.18	474.00	1249075.79	14301547.00	37687164925.01
North-West	3020.68	1156.00	3491909.55	34866770.00	105321459403.91
South East	2927.45	934.00	2734239.23	28171116.00	82469561705.32
South-South	2582.08	1256.00	3243094.99	37875186.00	97796836017.25
South-West	2681.11	882.00	2364737.26	26597483.00	71310724451.16

TABLE B2:1 Indirect Cost

	Malaria patient					Care giver				
Level/ Description	Mean Indirect cost	Sample size	Total sample indirect cost	National population size with malaria	National indirect cost patient	Mean Workdays lost	Daily income	Mean Indirect cost	Sample size	Sample Indirect cost
	6.00	7.00	8=6*7	9.00	10= 1*9	11.00	12.00	13=11*12	14.00	15=13*14
All	34047.60	2554.00	87000000.00	44000000.00	1500000000000.00	5.29	4828.73	25539.10	322.00	8223600.00
Urban	35242.10	654.00	23000000.00	32000000.00	1100000000000.00	4.94	4560.31	22509.70	109.00	2453556.00
Rural	33429.10	1900.00	64000000.00	12000000.00	400000000000.00	5.47	4962.93	27147.30	213.00	5782364.00
Male	33351.70	1021.00	34000000.00	19000000.00	620000000000.00	4.95	4196.71	20777.90	102.00	2119347.00
Female	32833.80	1523.00	50000000.00	25000000.00	820000000000.00	5.45	7514.79	40925.60	220.00	9003620.00
Poor	8354.35	163.00	1361759.00	2672216.00	22000000000.00	4.43	1450.45	6424.03	14.00	89936.40
Non poor	45011.00	2391.00	110000000.00	41000000.00	1800000000000.00	5.33	6517.87	34727.20	308.00	11000000.00
Informal employment	35221.60	2106.00	74000000.00	41000000.00	1400000000000.00	5.31	4744.08	25181.60	263.00	6622757.00
Formal employment	30099.50	141.00	4244025.00	2733146.00	82000000000.00	4.47	6946.32	31029.20	15.00	465438.00
Wage employment	30217.50	463.00	14000000.00	3577462.00	110000000000.00	4.50	6946.32	31258.50	16.00	500135.00
Self-employment in agriculture	32877.00	1395.00	46000000.00	21000000.00	700000000000.00	5.93	3411.20	20225.00	98.00	1982052.00
Other self-employment (Owned account)	39125.50	1310.00	51000000.00	19000000.00	730000000000.00	4.94	5555.40	27438.10	164.00	4499852.00
North-Central	23210.10	206.00	4781275.00	3520884.00	82000000000.00	4.47	5086.58	22742.10	34.00	773232.00
North-East	41789.20	251.00	10000000.00	4034437.00	170000000000.00	5.88	3847.33	22622.30	25.00	565557.00
North-West	29235.40	619.00	18000000.00	9835843.00	290000000000.00	5.41	2019.93	10921.80	81.00	884662.00
South East	38242.70	416.00	16000000.00	7947013.00	300000000000.00	4.53	2932.53	13269.70	59.00	782913.00
South-South	30524.10	641.00	20000000.00	11000000.00	330000000000.00	6.11	7105.48	43379.00	57.00	2472602.00
South-West	35908.70	421.00	15000000.00	7503095.00	270000000000.00	5.32	5055.74	26886.40	66.00	1774504.00

Note: Mean workdays lost by malaria patient already stated in findings of productivity loss. Total Population as at 2009 was 154,277,742 Source NBS 2012. Sample percentage of working population was 56.51% which yields 87182352 number of working population. If all in the working population had malaria and sample shows that half of those in the working population experienced missed workdays, then productivity loss is associated with 43521430 of the population. Using sample percentage distribution for each level, number of persons in national was determined and multiplied by mean productivity loss to get total productivity loss for each level. See table 5.1 for percentage distribution of persons with malaria for each level. Care givers in the working population are 322 in number. Which is is 0.0017% of the economically active population (188,499.2768) in HNLSS. Using percentage distribution of persons in the economically active population in HNLSS, this study determines distribution of persons who are caregivers at the different levels.

TABLE B2:2 Indirect Cost

Level/Description	Caregiver contd. Pop in nation 16.00	Care giver Indirect cost National 17=13*16	Total Indirect cost national 18= 10+17
All	148210.00	3785154417.00	1485585154416.62
Urban	38964.00	877076758.00	1113787076758.20
Rural	109246.00	2965717338.00	402185717338.40
Male	72919.00	1515111781.00	618554111781.13
Female	75291.00	3081312456.00	824597312455.76
Poor	6373.00	40940503.60	22365571995.61
Non poor	141837.00	4925599353.00	1843585599353.28
Informal employment	137657.00	3466433379.00	1440096433378.73
Formal employment	10553.00	327437454.00	82593677815.05
Wage employment	10553.00	329856416.00	108431856415.52
Self-employment in agriculture	64708.00	1308730409.00	699278730409.45
Other self-employment (Owned account)	72949.00	2001582352.00	734204582351.72
North cent	24558.00	558509514.00	82278470098.41
North east	23195.00	524720957.00	169120720956.90
North west	38712.00	422807718.00	287977807718.09
South east	17800.00	236201114.00	304151201114.13
South-south	22454.00	974023581.00	327109023581.34
South west	21490.00	577801473.00	270003801473.38

Table B 3. Cost Estimates as a fraction of GDP

Level/Description	Total cost Direct and indirect (national) 19= 5+18	Cost fraction in gdp 20=(19/GDP)*100
All	1906075224416.620	7.556
Urban	1410100772758.200	5.590
Rural	519134058335.136	2.058
Male	825163547358.634	3.271
Female	1039232133879.320	4.120
Poor	35551021866.307	0.141
Non poor	2252192554353.280	8.928
Informal employment	1824731408378.730	7.234
Formal employment	107798854373.606	0.427
Wage employment	141282680489.900	0.560
Self-employment in agriculture	913923884988.292	3.623
Other self-employment (Owned account)	884445079354.316	3.506
North central	108987720618.099	0.432
North east	206807885881.907	0.820
North west	393299267122.000	1.559
South east	386620762819.446	1.533
South-south	424905859598.592	1.684
South west	341314525924.544	1.353

APENDIX C. Percentage Distribution Of Persons (All Age And Working Population) (HNLSS)

	Population Distribution (%)All persons age HNLSS	**Distribution of the Economically Active population (%) HNLSS**
All	100	100
Urban	25	26.29
Rural	75	73.71
Male	50.62	49.2
Female	49.38	50.8
Poor	46.46	46.17
Non poor	57.96	53.83
Informal employment	93.34	92.88
Formal employment	5.66	7.12
Wage employment	5.65	7.12
Self-employment in agriculture	40.12	43.66
Other self-employment (Owned account)	54.22	49.22
North cent	16.4	16.57
North east	16.63	15.65
North west	28.32	26.12
South east	11.07	12.01
South-south	13.78	15.15
South west	13.82	14.5