

**AN ANALYSIS OF THE EFFECTS OF DEMOGRAPHIC AND  
EPIDEMIOLOGICAL TRANSITIONS ON HEALTH EXPENDITURE IN  
NAMIBIA**

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## ABSTRACT

Health expenditures have been on the rise in most countries including Namibia. Findings from studies that analyse the effects of demographic and epidemiological health outcomes on health expenditure can be used to determine if sufficient resources are being spent on health care, if they are appropriately allocated, and if not, how they could be re-allocated to achieve more value-for-money and bring about significant improvements in health outcomes. The study analysed effects of demographic and epidemiological health outcomes (infant mortality rate, life expectancy, HIV/AIDS and tuberculosis with the control variable GDP) on health expenditure in Namibia during the period 1990 to 2014. The results from the study indicate that total health expenditure (% of GDP) is integrated of order one,  $I(1)$  and cointegrated with all the other explanatory variables. Subsequently, cointegration analysis and VECM were employed to detect possible long run and short run relationships. The results from the study indicate that a long run relationship exists between the health outcomes and health expenditure. From the error correction model, only GDP was found to be significant to health expenditure. This finding is an indication that more needs to be done to improve health outcomes. Life expectancy, tuberculosis and GDP showed a positive relationship with health expenditure, whilst infant mortality and HIV were negative. Health outcomes such as HIV and infant mortality were insignificant, which is an indication that resources are not sufficiently spent on health outcomes that can be improved. Subsequently, policy recommendations from the study imply that certain strategies need to be put in place for appropriate allocation of resources and attention should be shifted to health outcomes that can be significantly improved with higher spending in order to allocate resources efficiently and cut costs.

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## **DEDICATION**

To my amazing husband Mr Mack Sanyauke and son Paul Sanyauke.

## DECLARATION

I, Lavinia Benetta Hofni, hereby declare that this study is my own work and is a true reflection of my research, and that this work, or any part thereof has not been submitted for a degree at any other institution.

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# CHAPTER ONE

## INTRODUCTION

### 1.1 Orientation of the Proposed Study

Countries experience demographic and epidemiological transitions at different times, whilst moving through them at different paces and sometimes they even undergo reversals (Fan & Savedoff, 2012). Demographic transition is characterised by two trends, a decline in mortality rates followed by a decline in fertility rates. This provides a framework for understanding rapid population growth and changes in demographic profile that has characterised social changes over the last two centuries (Defo, 2014).

The trend of declining mortality from infectious diseases and the subsequent fall in non-communicable diseases has shaped epidemiological transition. This has in-turn given rise to the evolving of populations in accordance to the burden of diseases. Namibia seems to be in an epidemiological transition where the greatest proportion of the disease burden is mainly accounted for by communicable diseases such as HIV/AIDS, malaria, tuberculosis, and non-communicable diseases such as cancer and cardiovascular problems which are among the top causes of death (Mwinga, 2012). Changes in these health outcomes can have important consequences for current and future health expenditure.

According to Fasoranti (2015), health expenditure is vital in improving the health status, life expectancy, efficiency and productivity of labour. It satisfies the fundamental individual and social demands for services. The World Bank (2014)

defines total health expenditure as the sum of public and private health expenditures. It covers the provision of health services (preventive and curative), family planning, nutrition, and emergency aid designated for health. Boyacioglu (2012) argued that all expenditures made for prevention, development, care, nutrition and emergency programs aimed at the improvement as well as the protection of health are accepted as “health expenditure”. As a result, health expenditure in rich and poor economies alike grew over the years with the hope of meeting health needs and improving health outcomes. However, despite relatively high rate of expenditure on health many countries are failing to improve their health outcomes.

Fan and Savedoff (2012) examined the determinants of growing health expenditures and found that the major factors are rising incomes, new medical technologies and changing medical practices, and aging populations. Additionally, three groups of independent variables are usually important in analysing health expenditure: health stock, demographic, epidemiological and economic variables (Anyawu & Erhijakpor, 2009; Abbas & Hiemenz, 2011). According to the WHO (2011), increments of health expenditure relate to increased costs of providing or financing health services, increased social security payments including disability or unemployment benefits, and reduced tax receipts. Admittedly, strategies that have significant impacts in terms of securing more fiscally sustainable sources of financing, management and ensuring greater benefits should be underpinned by robust analysis of demographic and epidemiological transitions (Agbatogun & Taiwa, 2010).

It is important to analyse whether the resources spent on health are appropriately allocated, and if not, how they can be re-allocated to achieve more value-for-money

and bring about significant improvements in the health outcomes. It is therefore, the composition of spending and how it is spent that affects its efficiency and equity (Fan & Savedoff, 2012). A secondary data search on research focussing on health expenditure, demographic and epidemiological health outcomes in Namibia failed to yield any tangible results. Available, similar or past studies (Angko, 2013; Olaniyan, Onisanwa & Oyinlola, 2013) are generally on the determinants of health expenditure with little or no incorporation of demographic and epidemiological health outcomes. Anyawu and Erhijakpor (2009), recommended further study to find out how health expenditures have been instrumental in bringing about progress in health status. They further recommend a deeper analysis on whether these programs have been effective. This study therefore presents an original approach which incorporates demographic and epidemiological health outcomes' effect on health expenditure in Namibia in order to analyse how the health outcomes impacted on health expenditure in bringing about progress.

## **1.2 Statement of the Problem**

Namibia faces many challenges such as a high prevalence rate of HIV, incidence of tuberculosis, low life expectancy and high rate of infant mortality. These health outcomes tend to increase health expenditure. For instance, health expenditure in Namibia increased to about 9% in 2014 from 6.2% in 1995 (National Planning Commission, 2014). As a result, health outcomes such as life expectancy and maternal mortality both improved over the years. Life expectancy fell from 60 years in 1990 to around 53 years in 2000 (National Planning Commission, 2014), but has since returned to around 60 years in 2016. Similarly, maternal mortality increased from 180 per

100,000 births in 1990 to 220 in 2000, before improving again to around 180 in recent years. Even though some health outcomes have improved with a rise in health expenditure in recent years, some health outcomes such as tuberculosis had little improvement. Data from the World Bank (2014) show that incidence of tuberculosis (per 100,000 people) rose from 575 in 1995 to 651 per 100 000 people in the year 2013, this occurred despite the increase in health expenditure (was 7.1% in 2008 and increased to 8.5% in 2013). As a result, health outcomes can put significant pressure on already weak health systems, reroute expenditure that could be used for other more important projects, undercut the process of economic development by compromising human capital and savings and weaken the income base.

Given that 44% of total health expenditure goes to paying for health care for only 19% of the population that is covered by some form of medical aid, this leaves only 56% of total health expenditure to cover the remaining 81% of the population indicating a strong likelihood for inequity in financing (Ministry of Health and Social Services, 2015). This phenomenon needs to be investigated further as it is important to understand whether health expenditure is sufficient and equitable in improving health outcomes. The government needs to understand where and by how much it's spending is not helping to provide care for those who need it most (Ministry of Health and Social Services, 2015). Conclusively, along with ever-increasing health expenditures comes the need to evaluate their effectiveness in improving health outcomes (Anyawu & Erhijakpor, 2009). Certain approaches such as identifying health outcomes that can be improved with more investment, predicting the effect of the health outcomes on health expenditure and establishing the type of relationship are crucial. There is extensive literature on health expenditures and their growth in Organisation for Economic Co-

operation and Development (OECD) countries, however, evidence from developing countries is relatively scarce (Xu, Priyanka & Alberto, 2011). This paper seeks to fill this gap by analysing the effects of demographic and epidemiological health outcomes on health expenditure in Namibia. It is for this cause that the analysis brings to the forefront the remedies to the obstacles under investigation.

### **1.3 Objectives of the Study**

The broad objective of this study is to determine the relationship between health expenditure, and demographic and epidemiological health outcomes. Specific objectives include:

- a) analyse the trend of health expenditure in Namibia for the period 1990-2014,
- b) investigate the effects of demographic and epidemiological health outcomes on health expenditure.

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

Ill-health affects employment, productivity and substantially economic growth. Knowing the effects of HIV/AIDS, tuberculosis, infant mortality and low life expectancies on health expenditure can motivate policy makers allocate resources to the specific health issues that can be positively improved with higher spending. This study can help identify the health outcomes that do not significantly affect health expenditure. Once this is achieved future research can focus on other means of improving health outcomes that do not necessarily depend on higher expenditure and in turn find new methods of improving them.

## **1.5 Outline of the study**

The remainder of the study is organised as follows: Chapter Two outlines the overview of health expenditure, demographic and epidemiological health outcomes in Namibia. Chapter Three surveys the theoretical and empirical literature. The empirical model, data sources and estimation techniques are discussed in Chapter Four. Chapter Five gives the empirical findings. Finally, Chapter Six draws the main conclusions and implications for policy of the study.



## **CHAPTER TWO**

### **NAMIBIA: AN OVERVIEW OF HEALTH EXPENDITURE, DEMOGRAPHIC AND EPIDEMIOLOGICAL TRANSITIONS**

#### **2.1 Introduction**

Namibia inherited a health care system which was once highly fragmented and biased towards curative care while being inefficient and inadequate (Brockmeyer, 2012). According to Brockmeyer (2012) prior to independence, economic inequalities were mirrored in the public health care system developed by the apartheid government. As a result health expenditure before 1990 mainly focused on meeting the health needs of previously-advantaged communities. During this time the public health system lacked both adequate health care facilities available to serve the previously-disadvantaged communities. It is due to this background that Brockmeyer (2012) highlights that, more work still needs to be done to bridge the gap in access to health care facilities between rural and urban areas, white and blacks as well as the rich and poor population.

Since independence, access to health care services in Namibia have greatly improved. Currently, the country has about 265 clinics, 44 health centres, 1150 outreach points, 30 district hospitals, 3 intermediate hospitals and one national referral hospital as well as various social welfare service points (Brockmeyer, 2012). However, problems that still negatively affect the smooth running of the national health care referral system still exist and these include: paucity of transport, inadequate communication network, insufficient resources, inadequacy in numbers and skills mix of key health personnel,

lack of equipment and insufficient level of infrastructure, and logistics (Ministry of Health and Social Services, 2014). Furthermore, the delivery of an efficient health care system is one the most challenging policy area in Namibia. This is more so because the country's population is scattered all over the vast Namibian land space making it hard to reach the remotest areas to provide health care services. This chapter therefore, presents an overview of the Namibian health system, the transition of demographic and epidemiological health outcomes and the health expenditure in Namibia.

## **2.2 Health Expenditure**

The Ministry of Health and Social Services (2015) highlighted the implications for policy in terms of health expenditure as follows: increasing government health expenditure to achieve the Abuja target, shifting attention and funding to non-communicable diseases, mobilising domestic resources and containing the increases in household out-of-pocket expenditure.

**Table 2.1: Trends of Namibian Health Expenditure: 2008-2013**

	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
<b>Health expenditure, total (% of GDP)</b>	7.1	8.1	7.9	8.8	8.2	8.5
<b>Health expenditure, public (% of total health expenditure)</b>	54.5	54.9	58.2	60.5	58.9	59.0
<b>Health expenditure per capita (current US\$)</b>	286.0	332.0	405.6	486.5	467.9	470.0
<b>Out-of-pocket health expenditure (% of total expenditure on health)</b>	8.1	8.1	7.5	7.1	7.4	7.4

Source: Ministry of Health and Social Services (MoHSS), National Statistics Agency (NSA), and ICF International (2014)

Table 2.1 illustrates health expenditure in Namibia. Total health expenditure as a % of GDP was 7.1% in 2008 before it increased to 8.5% in 2013. Public health expenditure as a % of total health expenditure was 54.5% in 2008 before increasing to 59.0% in 2013. Per capita health expenditure in current US\$ was 286.0 in 2008 and 470.0 in 2013. Levels of out-of-pocket health expenditure as a % of total expenditure on health from 8.1% in 2008 to 7.4% in 2013. This reduction can be an indication of inefficient utilization of available resource.

The rise in health expenditure can exert a burden on Namibia's GDP through inducing a deficit in the budget, hampering the provision of health care services, and negatively

affecting patients out of pocket finances. This is shown in the revenue forecasts for the 2016/2017 financial year that have been revised down by N\$6.3 billion (from N\$57.8 billion to N\$51.5 billion) (Kaira, 2016). The expenditure had to be cut in order to avert an unsustainably large budget deficit that might have ensued. Financing sources for health include all the entities and institutions that contribute to the health system. According to the Ministry of Health and Social Services (2015), the public sector controlled 68.1% of total health expenditure, private sector, including households, followed at 22.3% and donors and international NGOs controlled less than 10%. Hence, the government of Namibia via its tax based revenue is the biggest contributor to health care delivery in the country.

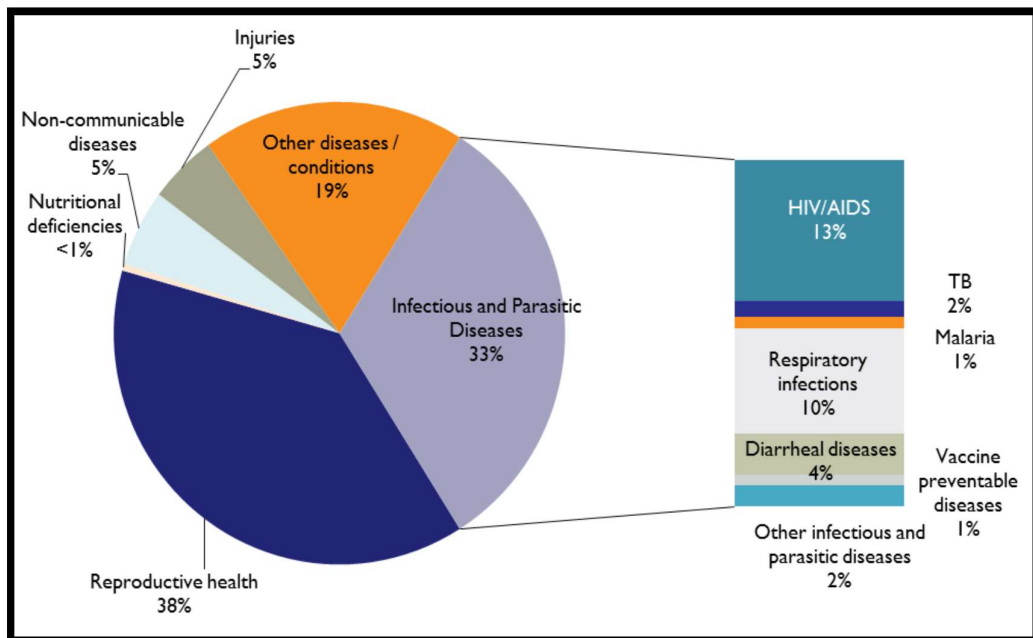
### **2.3 Demographic and Epidemiological Transitions in Namibia**

Demographic transition is defined as the transition from high birth and death rates to lower birth and death rates as a country or region develops from a pre-industrial to an industrialised economic system. Between 1980 and 2014, Namibia's life expectancy at birth increased by 7.1 years, from 57.7 years to 64.8 years, respectively (Jahan et al., 2015).

The epidemiological transition is a shift from acute communicable diseases of poverty to the chronic non-communicable diseases of high income societies. Namibia, similar to other countries that are in an epidemiological transition, is experiencing an increase in non-communicable diseases, obesity, and other conditions associated with urbanisation and modern, less active lifestyles, combined with new and re-emerging infectious diseases such as HIV/AIDS and sexually transmitted infections. This poses

a double burden on the country, with Namibia facing exposure to disease characteristics of both developed and developing societies. Fan and Savedoff (2012) postulate that demographic and epidemiological transitions are inevitable and the underlying causes are not predetermined.

**Figure 2.1: Health Expenditure by Disease Condition, 2012/13**



Source: Ministry of Health and Social Services (2015)

Figure 2.1 shows that the reproductive health receives the highest allocation of funds, followed closely by infectious and parasitic diseases. Within the infectious and parasitic diseases category, spending is highest on HIV/AIDS, respiratory infections and non-communicable diseases, respectively.

### **2.3.1 Epidemiological Transition**

In addition to accommodating changes in population size and structure, countries across the globe are progressing through an epidemiological transition that has important implications for life expectancy, burden of disease, and (in turn), health financing (Gottret & Schieber, 2006).

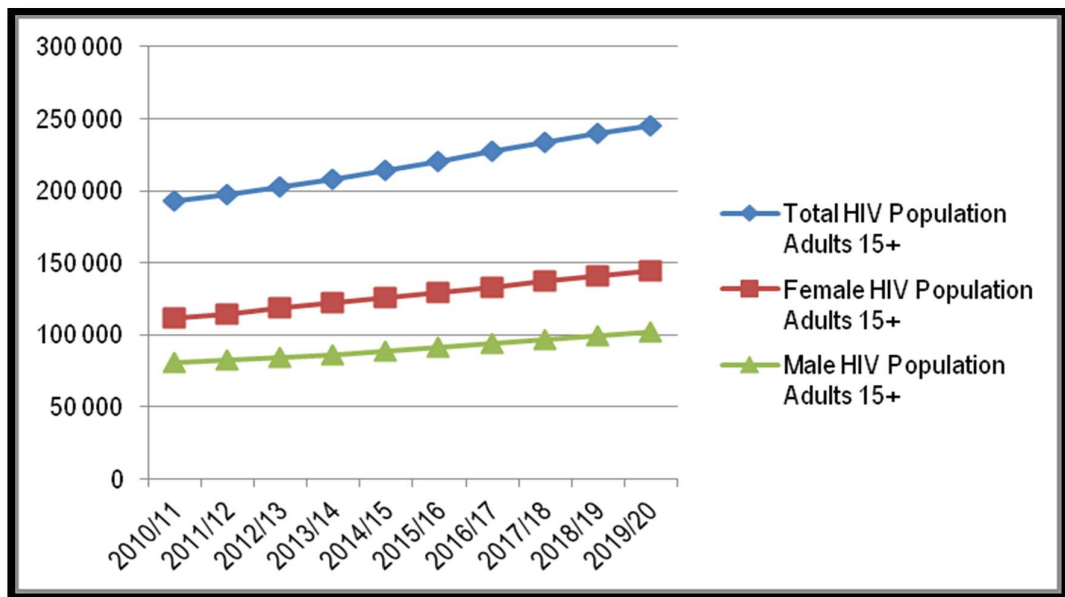
#### **2.3.1.1 HIV/AIDS**

After the first HIV case in Namibia was diagnosed in 1986, the country witnessed a rapidly expanding HIV epidemic. Between 1992 and 2002, the country witnessed an increase in the prevalence of HIV from 4.2% to 22% (Ministry of Health and Social Services, 2015). Unfortunately, the HIV prevalence since 1986 to 1992 is not well documented. Namibia now faces a mature generalised HIV epidemic with an estimated adult prevalence of 17% in the current year (2016). The 2014 national HIV sentinel survey indicates that HIV prevalence is highest among women aged 40-44 years at 30.6%, and women aged 35-39 years at 30.3% (Ikela, 2016). Key drivers of the epidemic are related to underlying social, economic and cultural factors. The Ministry of Health and Social Services (2015) identified multiple and concurrent partnerships and intergenerational sex as the main drivers of the HIV epidemic in Namibia. Other contributing factors include alcohol abuse and low levels of HIV risk-perception and high levels of population mobility (Ministry of Health and Social Services, 2015).

In recognition of the increased health burden associated with HIV and AIDS, the Government of Namibia has utilized various mechanisms and resources to mitigate the

impact of the epidemic (Ministry of Health and Social Services, 2015). These include, coordinated involvement of various national and international stakeholders, including broader civil society, which have been deemed essential in effective HIV response. HIV/AIDS remains a top contributor to morbidity in Namibia, however, 51% of HIV/AIDS funding comes from donors, and therefore it remains heavily donor-financed (Ministry of Health and Social Services, 2015). Subsequently, Namibia has made tremendous progress in its HIV/AIDS response. This response has seen the country implementing a combination of interventions targeting behavioural, biomedical and structural drivers of the epidemic in accordance with the National Strategic Framework. Unfortunately, the pace of redressing inequities in the distribution of scarce health care resources in Namibia has been slow.

**Figure 2.2: Actual (2010/11- 2016/17) and Estimated (2017/18-2019/20) Adult Population Aged 15/above with HIV**



Source: Ministry of Health and Social Services (2014)

Figure 2.2 shows the Ministry of Health and Social Services (2014) HIV/AIDS update. It was reported that, HIV prevalence amongst people aged 15 and above was estimated at 12.8% in 2013/14. Furthermore, approximately 208,000 of people aged 15 and above were estimated to be living with HIV. This figure is projected to increase to over 227,000 by 2016/17, and to over 245,000 by 2019/20. According to recent research, an estimated 73% of new infections in the age group 15-19 years is among young girls, while among boys it is 27%. In the age group 20 -24 years, girls account for 62% of new infections (Ikela, 2016).

### **2.3.1.2 Tuberculosis**

The restructuring of the health system is serving as an important opportunity to build synergies among programmes such as the non-communicable, Tobacco Control Programme (TCP), health promotion, and community based-programmes. AIDS, diarrhoea, pneumonia, pulmonary tuberculosis, heart failure, and other respiratory system ailments, such as anaemia, malnutrition, stroke and malaria are one of the main killers in Namibia. The World Health Organization (WHO) ranked Namibia number four on the list of the world's worst-hit countries in terms of tuberculosis (Van Gorkom et al., 2013). The prevalence of tuberculosis has only shown a marginal decrease over the last 10 years. Tuberculosis prevalence per 100,000 people increased from 657 in 2000 to 822 in 2004 but has since fallen to 561 in 2014 (National Planning Commission, 2014). Particularly the challenge faced in Namibia is the high tuberculosis/HIV co-infection rate and the emergence of drug resistant tuberculosis.



The Namibian Global Health Initiative (2011-2015/16) report highlighted specific challenges to the Ministry of Health and Social Services which include low quality and inconsistent Monitoring and Evaluation (M&E) of data; inadequate linkages between the community and facility-based programs; low intensified tuberculosis case findings; staff shortages and high staff turnover.

## **2.3.2 Demographic Transition**

### **2.3.2.1 Life Expectancy**

In Namibia, life expectancy for males and females can be separated into two distinct phases: a phase of decline (phase 1, from 1990 to 2004), and a phase of increment (phase 2, from 2004 to 2013) (Institute for Health Metrics and Evaluation (IHME), 2016). In phase 1, as the HIV epidemic began to take hold, life expectancy for males and females dramatically declined. For females, life expectancy decreased by 12 years (66 years in 1990 to 54 years in 2004). For males, life expectancy decreased by nine years (59 years in 1990 to 50 years in 2004). In phase 2, as the incidence of HIV declined, life expectancy increased for both males and females. For males, life expectancy increased by six years (from 50 years in 2004 to 56 years in 2013). In phase 2, life expectancy for females increased by 11 years (from 54 years in 1990 to 65 years in 2013). The increase in life expectancy can be attributed to the successful treatment of tuberculosis cases; 85% of people were successfully treated in 2010; the reduction in malaria mortality (Namibia reduced deaths due to malaria by 0.4% in 2012); the decline of HIV prevalence rate in pregnant women and the provision of Anti-Retroviral drugs (ARVs) (Institute for Health Metrics and Evaluation (IHME), 2016).

Furthermore, the life expectancy for urban dwellers is higher than that of people living in rural areas by more than six years.

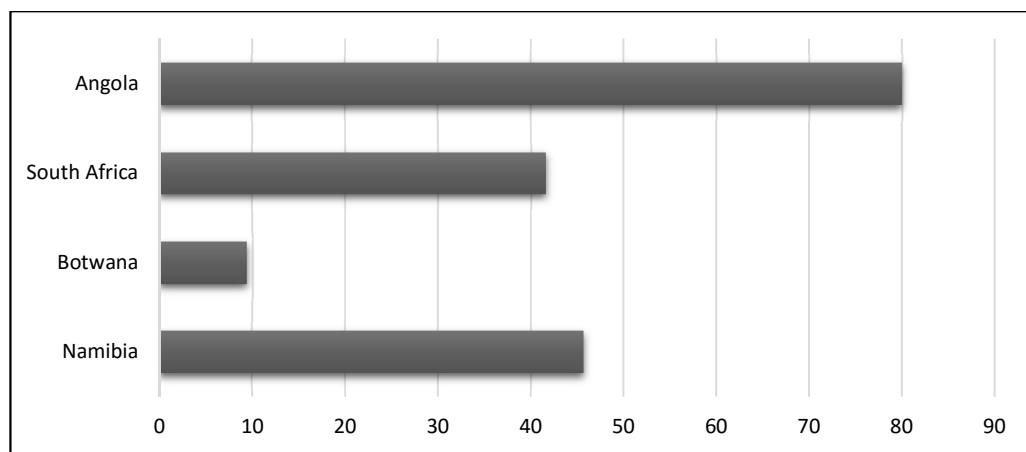
### **2.3.2.2 Childhood Mortality**

Mortality decline is a second key feature of the demographic transition: pre-transition societies are marked by high mortality rates among all age groups, but as the transition progresses, mortality rates fall, first among children and gradually among adults (United Nations, 2012). Information on infant and child mortality is important for the improvement of child survival programs and for identifying those segments of the child population that are most vulnerable (Ministry of Health and Social Services (MoHSS), National Statistics Agency (NSA), and ICF International, 2014).

Mortality in early childhood in Namibia is measured using the following five rates: Neonatal, post-neonatal, infant, child, and under-five mortality rates by five-year periods. Infants born to mothers especially in rural areas with little or no education have a higher probability of dying at the age of 0 than those born to mothers who completed secondary education (Ministry of Health and Social Services, 2014). Moreover, Namibia is ranked 59<sup>th</sup> in the world for under-five mortality, which has decreased between 1990 and 2013 from 73 to 50 deaths per 1000 population (Ministry of Health and Social Services, 2014). Despite this decrease, the average annual rate of reduction is only 2.3 deaths per 1000 population. At the same time, spending on maternal, child and adolescent health is declining and emergency obstetric care coverage is very low and inequitable.

New-born mortality accounts for 50% of child mortality. Neonatal mortality declined only marginally, from 23 to 19 per 1,000 live births, between 2001 and 2011, and maternal mortality is at the same level as it was in 1995, 200 per 100,000 births (WHO, 2011). The underlying causes of maternal and neonatal deaths include the lack of skilled personnel, as well as the long distances and delays in seeking care.

**Figure 2.3: Infant Mortality Rate (deaths per 1,000 live births)**



Source: Central Intelligence Agency (2016)

An analysis of Figure 2.3 shows that infant mortality in Angola was the highest with 79.99 deaths per 1000 live births, followed by Namibia with 45.64 and South Africa with 41.61 respectively. Botswana had the lowest rate of infant mortality with 9.38 deaths per 1000 live births. The figures show that, Namibia is likely to reduce the current infant mortality rate to the target of 30 deaths for every 1000 live births by 2017. This is because the current rate of infant mortality stands at 33 deaths per 1000 live births in 2016. With effective allocation of resources, this health outcome can be improved.

## **CHAPTER THREE**

### **LITERATURE REVIEW**

#### **3.1 Introduction**

This Chapter looks at different methods employed in literature. It provides a guidelines on how to best tackle the issue of analysing the effects of demographic and epidemiological transition on health expenditure; it also gives direction as to which models are still relevant in analysing health expenditure and finally which econometric tools to employ when handling health expenditure data. Chapter Three contains entails the reviews of both theoretical and empirical literature. This Chapter therefore summarises the lessons learnt and major findings of the reviewed literature that served as a guide in our model formulation.

#### **3.2 Theoretical Literature**

Two paradigmatic transitions have offered considerable insight into changes within populations over time: the epidemiological and demographic transition (Collinson et al., 2014). Both are the subject of extensive writing, which include critiques of these as contemporary paradigms. In its conventional sense, generally the Epidemiological transition is a shift from acute communicable diseases (CDs) of poverty to the chronic non-communicable diseases of high-income societies. Defo (2014) divided the epidemiological transition into three phases: the age of pestilence and famine where mortality is high and fluctuating, precluding sustained population growth; the age of receding pandemics where mortality progressively declines and; the age of

degenerative and man-made diseases where mortality continues to decline and eventually approaches stability at a relatively low level.

According to Defo (2014) the non-western (upper and lower) intermediate transition model embodies the experience of middle- or low-income countries such as Indonesia, Colombia, Tunisia, Egypt, Morocco, and the Dominican Republic. These countries still face a dual burden of continuing communicable diseases, malnutrition and the rising prevalence of non-communicable diseases, often in combination with the emerging diseases such as HIV/AIDS or resurgent diseases such as malaria. The non-western slow transition model describes the experience of the least developed countries and some of the less developed countries in Latin America, Asia and Africa. In these countries, mortality started declining to moderate levels after 1950 while fertility remained at high levels until the 1990s. Defo (2014) further highlighted that these countries also faced the dual burden of the continuing preponderance of communicable diseases and malnutrition and of the rise in degenerative and man-made diseases, along with HIV/AIDS, malaria, tuberculosis and other emerging or resurgent diseases; they also have been ill-prepared to handle any one health problem.

Populations have tended to shift over time from being characterized by high fertility and mortality to low fertility and mortality, this process is known as the demographic transition (United Nation, 2012). The transition involves four stages. According to Barma (2013) stage one is characterised by a pre-industrial society, death rates and birth rates are high and roughly in balance. In addition, stage two for developing countries, the death rates drop rapidly due to improvements in food supply and sanitation, which increase life spans and reduce disease. These changes usually come

about due to improvements in farming techniques, access to technology, basic health care, and education. Without a corresponding fall in birth rates, this produces an imbalance, and the countries in this stage experience a large increase in population (Barma, 2013). In stage three, birth rates fall due to access to contraception, increases in wages, urbanization, a reduction in subsistence agriculture, an increase in the status and education of women, a reduction in the value of children's work, an increase in parental investment in the education of children and other social changes. Population growth begins to level off. During stage four there are both low birth rates and low death rates. Birth rates may drop to well below replacement level as has happened in countries like Germany, Italy, and Japan, leading to a shrinking population, a threat to many industries that rely on population growth. As the large group born during stage two ages, economic burdens are created on the shrinking working population. Death rates may remain consistently low or increase slightly due to increases in lifestyle diseases due to low exercise levels and high obesity and an aging population in developed countries.

The epidemiological transition is embedded within the demographic transition through mortality reduction. Population growth rates are low or near-nil at the beginning and end of the transition, while population growth can be substantial in the interim phase. Collinson et al. (2014) argue that while the basic demographic transition is a highly structured paradigm, variations in the relationship between mortality and fertility trends across time and space have important implications for age structure and economic development.

In rich and poor countries alike, health needs are changing in response to the demographic and epidemiological transitions. Gottret and Schieber (2006) established that the demographic and epidemiological transitions will pose health challenges for countries at every income level. In addition, middle income countries and most low-income countries, which are already hard pressed to provide even the most basic health services, will find it hard to meet projected health needs which are likely to require additional funds from external financing sources. Gottret and Schieber (2006) granted that most low-income countries, particularly those in Africa, are far off track for reaching the Millennium Development Goals (Now transitioned to Social Development Goals (SDG's)) for health. Therefore, to improve the equity and efficiency of their health financing systems, low-income countries will need to improve the public sector management; significantly increase their current government health spending levels through enhanced domestic resource mobilization, improvements in the efficiency of public spending, and large increases in grant-based and sustainable external assistance; improve financial protection to the greatest extent feasible through appropriate risk pooling mechanisms adapted to country-specific circumstances; and improve the technical and allocative efficiency of government health purchasing decisions.

### **3.2.1 Implications of Health Expenditure**

Demographic and epidemiological health outcomes impose economic consequences in the form of increased health expenditures. This is the case, for instance, when there are increased health expenditures resulting from disease and injury at the household level, when firms make investment in health and safety to protect the wellbeing of their

workers, or when governments are forced to provide care to prevent or treat disease (World Health Organization (WHO), 2009). Additionally, increased health expenditures are foreseen to impact on government's resources, by reducing the amount of household taxable income and increasing the amount of spending that have to be covered out of public funds. Furthermore, the resulting impact on public budgets limits the governments' ability to spend resources in other areas, particularly in social expenditures such as education and in public investments in infrastructure projects, sanitation, science and technology.

The onset of diseases, especially in developing countries with limited coverage of social protection systems, often forces households to adapt patterns of consumption in order to cope with the additional burden. The increase in the consumption of health-related services and goods frequently leads to a corresponding reduction in the resources available for savings and investment. According to WHO (2009) increased health expenditures exert an overall negative impact on savings at the societal level. Several studies have assessed this negative impact on savings and have shown that it is likely to be considerable, especially in the case of epidemics such as HIV/AIDS (Cuddington, 1993; Cuddington & Hancock, 1994; Arndt & Lewis, 2000; Hacker, 2002 as cited in WHO, 2009). On the other hand, lower aggregate savings are likely to lead to increases in interest rates and the opportunity cost of investment, which can then impact negatively on the formation of capital and ultimately on economic growth.

Consequently, reductions in public investment resulting from increased health expenditures can seriously compromise long run economic growth potential. On the other hand, tighter overall budgets can compel governments to increase the level of



taxation in order to meet increased additional health expenditures. This in turn can have macroeconomic repercussions by depressing aggregate demand and therefore limiting the growth potential of the economy (WHO, 2009).

### **3.2.2 Demographic Transition**

According to the WHO (2011) all countries are experiencing varying degrees of demographic change. That is, high-income countries have low fertility and low mortality, and most of the low-income countries are moving from high to low fertility, with significant variations in mortality levels. Improvements in health and sanitation conditions cause significant declines in rates of child mortality and consequent demographic explosion with exponential rates of population growth (WHO, 2009). Moreover, as parents adapt to the new environment with low child mortality, the fertility rates also tend to decline. Thus, projections for the next 50 years generally assume that population growth rates will fall, life expectancies will increase, and fertility rates will decline in all regions (Defo, 2014).

As a result of varying patterns of demographic change, regions around the world will confront health challenges of different degrees and at different times. For instance, according to Defo (2014) Danish health expenditure may escalate simply because the health system has the capacity to provide care to the elderly. In contrast, Sierra Leone does not have the health system capacity to provide such care. The increase in the proportion of the elderly population will lead to some rise in overall health expenditures (Gottret & Schieber, 2006). Felder (2013) showed that men and women in the developed world have experienced a significant increase in life expectancy over

the last 50 years, and so per capita health expenditure has increased dramatically. Mahumud et al. (2013) showed that life expectancy was one of the major key indicators of population health condition and economic development of a country. Therefore, improvements in health and welfare increases life expectancy.

As a consequence, the effect of a longer life on future health expenditure will be quite moderate because of the high costs of dying and the compression of mortality and morbidity in old age (Felder, 2013). Felder (2013) granted that proximity to death, and not age per se, determines the bulk of expenditure, a shift in the mortality risk to higher ages will not significantly affect lifetime health expenditure, as death occurs only once in every life. An exception to this rule is long-term care. As more people reach a very high age the percentage of people needing long-term care in their last years of life increases.

In addition, Aksan and Chakraborty (2014) indicated that when child mortality (another demographic health outcome) falls, the labour productivity improves, fertility falls and health expenditure increases. When it falls mainly from better cures, survivors are less healthy and there is little economic growth. Anyawu and Erhijakpor (2009) highlighted infant mortality as a sensitive indicator of the availability, utilisation and effectiveness of health expenditure. Though greater expenditure on health outcomes is being advocated by many, little empirical evidence exists on the beneficial impact of such expenditure on infant and child mortality (Anyawu & Erhijakpor, 2009).

The size and structure of the population will surely have important consequences for current and future health expenditure needs, however, the exact impact is subject to

debate. Gottret and Schieber (2006) show that health expenditures among an aging population will continue to exert significant pressures on health systems for years to come; others contend that at least in the high-income setting, the aging populations are increasing but healthier, so the effect on health expenditures may not be as serious as anticipated. In contrast, developed economies are currently facing the challenges associated with supporting populations that have a large proportion of aging individuals. Furthermore, lessons learned from high-income countries regarding best practices to support an increasing aging population structure may prove useful to low- and middle-income countries in the years to come. For example, the lessons learned by Denmark - a high-income country where the population has a long life expectancy - may prove useful to countries such as Sierra Leone, a low-income country where life expectancy is short (Defo, 2014). The two countries have dramatically different health expenditure because of the age distribution of deaths in their respective populations.

Sub-Saharan Africa, a low income region characterized by high population growth rates and short life expectancies, will experience a 52% increase in health expenditure (Gottret & Schieber, 2006). Resultantly, Europe and Central Asia, which are middle-income regions with close to zero population growth and long life expectancies, health expenditure is expected to rise by 14%. Latin America and the Caribbean, which are middle-income regions with moderate population growth rates and long life expectancies, will experience an overall expenditure increase of 47%. In East Asia and the Pacific, health expenditure will increase by 37%. In South Asia total expenditure will increase by 45%. Although this analysis by Gottret and Schieber (2006) is simplistic, it does indicate the orders of magnitude of spending changes that are likely to result as populations grow and age.

Excluding Europe and Central Asia, overall increases of 37% to 62% of health expenditures indicate that governments would need to increase their health expenditure just to accommodate demographic changes. They are clearly lower Bounds on increases, because they do not take into account critical factors such as the development of new technology, the pace of inflation, or the scope of insurance coverage (Gottret & Schieber, 2006). Nor do these estimates include the impact of potential new medical crises such as avian flu or the availability of new and expensive drugs to treat malaria.

### **3.2.3 Epidemiological Transition**

Adogu et al. (2015) states that demographic changes and the epidemiological transition are closely related. As discussed earlier, mortality levels start to decline at the beginning of the demographic transition. This is mainly caused by the reduction in mortality from infectious diseases and maternal and childhood conditions. As fertility levels and the burden of communicable diseases decline, and the average age of the population increases, health expenditures increase. The increase in the number of susceptible individuals at older ages increases the overall incidence and prevalence of non-communicable diseases, thereby, accelerating the epidemiological transition. Most developing countries are currently confronting a significant challenge because of a continued high burden of communicable diseases. These diseases (particularly malaria, tuberculosis, and HIV/AIDS) pose a serious challenge for public health and health systems in many low-income and some middle-income countries (Gottret & Schieber, 2006). Omoleke (2013) identified a scourge of infectious diseases such as HIV/AIDS, tuberculosis, malaria, pneumonia and diarrhoea as public health

challenges faced by Africans. Most developing countries have been experiencing increasing life expectancy, though, the gains (increasing life expectancy) of the mid-20th century were threatened by HIV/AIDS and tuberculosis, as many young and middle aged people died of this deadly combo.

According to the WHO (2011), diseases and injuries impose economic consequences in the form of increased health expenditures for almost all economic agents. Taskaya and Demirkiran (2016) found that health was one of the main determinants of economic development. Stimulating aggregate demand can increase health expenditures which can have a positive influence on economic growth (WHO, 2011). HIV/AIDS requires testing, counselling, treatment of opportunistic infections, and administration of antiretroviral therapy. Therefore, more money is allocated to the treatment of HIV/AIDS as it is more costly to treat (UN, 2015). This would amplify the impact on total health expenditure.

Admittedly, Gottret and Schieber (2006) show that saving lives is of utmost importance and urgency in affected countries, but providing antiretroviral therapy is a long-term and costly undertaking, even if the drugs themselves are funded or subsidized by external sources. Mahomed and Asmall (2015) argued that, as the burden of chronic diseases (both communicable and non-communicable diseases) increases, providing affordable and effective care to the often large and increasing numbers of people will be an immense challenge. As a result, evidence suggests that some countries such as South Africa's response to non-communicable diseases have little effect due to the rising incidence of deaths from non-communicable diseases in

rural areas and the increasing pressure on health care services from acute and chronic diseases (Mahomed & Asmall, 2015).

Tuberculosis is another highly prevalent and expensive disease in low-income countries, even though most of the cost for the treatment are borne by external donors (Gottret & Schieber, 2006). The most successful method for treating tuberculosis suggested by Gottret and Schieber (2006) requires an adequate supply of antibiotics as well as intensive participation of health staff to monitor the administration of treatment, which raises both cost and work force issues. Tuberculosis therefore causes catastrophic health expenditures. Accordingly, the recent outbreaks of Sudden Acute Respiratory Syndrome (SARS), as well as avian influenza in Asia and Europe, are chilling reminders that even the most prescient planning in health systems and health expenditure may not be enough to counter the global threat of emerging infectious diseases. Therefore, it is important to have measures in place to deal with these outcomes.

The epidemiological transition influences health systems and health expenditure by affecting population health needs (Gottret & Schieber, 2006). Hence, as disease burdens shift, health systems need to adapt by expanding or narrowing the scope and scale of services provided and integrating new technologies and approaches as needed. As a result, coping with the current burden of communicable diseases, and at the same time laying the groundwork for transforming the health system to deal with the impending non-communicable disease burden, presents the major challenge for health policy makers in both African and other developing countries.

### 3.3 Empirical Literature

There is a strong relationship between GDP per capita, number of doctors, hospital beds, health outcomes and health expenditure (Khan, Razali & Shafie, 2016). To determine which factors are the most important for explaining health expenditures at the national, regional or international level, some studies such as Mahumud et al. (2013) used regression and correlation analysis. Tang (2011) and Christiansen et al. (2006) tested for unit root, cointegration and error correction tests. Other studies used Autoregressive Distributed Lag (ARDL) approach (Chaabouni & Abednnadher, 2014; Khan, Razali & Shafie, 2016; Nordin, Nordin & Ahmad, 2015).

In all the studies reviewed there existed a long run relationship between health outcomes and health expenditure. Abbas and Hiemenz (2011) found a long run relationship between health expenditure, income, population less than 14, population hospitals, unemployment and urbanization. The results of the Bounds test used by Anyawu and Erhijakpor (2009) showed that there was a stable long-run relationship between per capita health expenditure, GDP, population aging, medical density and environmental quality. Khan, Razali and Shafie (2016) found a long run relationship between health expenditure and GDP. There is a long run relationship between population growth, aging and health expenditure (Anyawu & Erhijakpor, 2009; Abbas & Hiemenz, 2011).

Health expenditure is a necessity (Abbas & Hiemenz, 2011; Omotor, 2009; Ahmed & Zaman, 2014; Angko, 2013; Anyawu & Erhijakpor, 2009; Fazoranti, 2015; Imuoghele & Ismaila, 2013; Khan, Razali & Shafie, 2016). This implies that public financing may

impact health expenditure more than any other determinant including per capita income. This strand of literature emphasized on measuring the size of income elasticity of health care, and the policy effects for investing and delivery of resources. On one hand, supporters of health expenditure being a necessity, stress the role of government control and intervention in the delivery of health (Khan, Razali & Shafie, 2016). Whereas, advocates of health expenditure being a luxury commodity claim that it should be put up for market forces. According to Khan, Razali and Shafie (2016), if health expenditure is found to be a necessity, governments will have a larger role in allocating and diverting public resources to health care. In contrast, Ahmed and Zaman (2014) concluded that health expenditure was a luxury item for low income countries; therefore, there was an immense need to provide the basic health services both from public and private sources.

An analyses of the effects on health expenditure is typically conducted by testing the causality between the variables to find out the direction of causation and for policy implications. Anyawu and Erhijakpor (2009) studied the causality and found a bidirectional causal flow from health expenditure to income, both in the short and in the long run. Khan, Razali and Shafie (2016) also confirm a bidirectional relationship between health expenditure and GDP. The results from Tang (2011) showed that health spending and income were bidirectional Granger causality in the long run. However, there has been some criticism of the causality test. For instance, data that had undergone logarithmic transformation showed no sign of causality while the untransformed data yielded significant results. Furthermore, the results of the causality test have given some conflicting results. Unlike the previous studies, Fazoranti (2015) found a uni-directional causality that runs from total government health expenditure



to total population of age 65 and above and life expectancy rate. Similarly, Chaabouni and Abednnadher (2014) established a unidirectional causality flowing from health expenditure to income. To overcome these problems, the Vector Auto Regressive (VAR) modelling approach as a method of carrying out econometric analysis with a minimum of a priori assumptions about economic theory can be used (Chaabouni & Abednnadher, 2014).

While analysing the determinants of health expenditure using time series data from Pakistan, Abbas and Hiemenz (2011) found that demographics such as urbanization and unemployment were variables that had a negative effect on health expenditures. They analysed the data using Johanssen cointegration and error correction approaches. Ahmed and Zaman (2014) found that total life expectancy and urban population had a positive relationship with health expenditure. They examined the key determinants of health expenditures, by using the cross sectional data of 99 developing countries, over the period of 1960 to 2011. The study used multiple correlation, ordinary least square regression (OLS) method, with diagnostic tests on residuals, and stability test of the model. Agbatogun and Taiwa (2010) also used simple regression analysis that showed GDP as the most important determinant of health expenditure in Nigeria. Other factors such as literacy rate and population growth rate were found to be statistically insignificant though positively related to health expenditures.

In another study on determinants of health expenditure, Fazoranti (2015) analysed the data with the aid of descriptive statistics and the Ordinary Least Square (OLS) multiple regression. Other tests employed were the Augumented Dickey-Fuller unit root test, Johansen co-integration test. The study found that per capita GDP, total population of

age 65 and above, total population of age 14 and younger and life expectancy rate had a positive effect on government health expenditure.

When examining the demand-side macroeconomic determinants of publicly financed health expenditure in Ghana, Angko (2013) employed annual time series data from 1970-2006. The study used an error correction model to capture both short-run and long-run relationships. They found that per capita income and other macroeconomic and demographic factors such as health status of the population and age structure of the population influence health care. Imuoghele and Ismaila (2013) used the same technique as Angko (2013) in examining the determinants of public health expenditure in Nigeria. The results from the error correction test show that total population of 14 years of age and younger and gross domestic product (proxy for government developmental policy on health) were the major determinants of health expenditure in Nigeria while gross domestic product per capita, unemployment rate, population per physician, consumer price index and political instability are insignificant.

Kim and Lane (2013) empirically analysed the relationship between public health expenditure and national health outcomes among developed countries. The data were collected from 17 OECD countries between 1973 and 2000. Two public health outcome indicators, infant mortality rate and life expectancy at birth were used as dependent variables. To analyse cross-country panel data, Kim and Lane (2013) analysed panel data using the mixed-effect model. A statistically significant association was found between public health outcomes and government health expenditure. Particularly, the findings showed a negative relationship between government health expenditure and infant mortality rate, and a positive relationship

between government health expenditure and life expectancy at birth. The results suggest that higher government spending on medical goods and services can provide better overall health results for individuals.

A study by Christiansen et al. (2006) determined the relationship between aging and health expenditure. They used panel data for 26 European countries for 24 years. They found a negative relationships between health expenditure and the 0-5 and 75+ age groups, while a positive relationship between health expenditure and age 65-74 seems to be present. They also found a high positive correlation between health expenditure per capita and GDP per capita

Closely similar to Abbas and Hiemenz (2011), Ahmed and Zaman (2014) and Fazoranti (2015), Chaabouni and Abednnadher (2014) examined the determinants of health expenditure in Tunisia during the period 1961-2008, by using the ARDL approach. The results show that there was a stable long-run relationship between per capita health expenditure, GDP, population aging, medical density and environmental quality. They further found short-run and long-run results which revealed that health care was a necessity, not a luxury good. They recommended that policies aiming at encouraging health expenses are required to build up a healthier and productive society to support the Tunisian's economic growth and development.

Khan, Razali and Shafie (2016) modelled the determinants of health and effects of these determinants on health expenditure. For the empirical investigation, the paper used Augumented Dickey Fuller and Phillip Perron (PP) tests to check for unit root and Autoregressive Distributed Lag (ARDL) approach for cointegration. The

regression results confirmed that income per capita had a positive and significant effect on health expenditure, moreover, population growth and structure had a significant negative effect on health expenditure. The effect of technological progress and life expectancy had a positive significant influence on health expenditure.

Studies that incorporated epidemiological health outcomes in the studies such as Xu, Priyanka and Alberto (2011) found a positive correlation between an aging population and health expenditure particularly for upper middle and high income countries where population aging is advancing fast, for low income countries, aging was not a dominant issue. Conclusively, tuberculosis prevalence was not associated with government health expenditure. Population aging contributes to higher total health spending largely through its effect on out-of-pocket health expenditures, though the levels of significance are weak (Fan & Savedoff, 2012). Few studies address the impact of population aging in low- and middle-income countries but when they do, the impact is generally small or insignificant (Xu, Priyanka & Alberto, 2011). Infant mortality and per capita total health expenditure were statistically significant in Anyawu and Erhijakpor (2009) study. They adopted a Robust Ordinary Least Squares (ROLS) model as the baseline specification and provided results from robust OLS using lagged explanatory variables. In the basic ROLS case a 10% increase in per capita total health expenditure reduces infant mortality rate by 22%.

### **3.4 Lessons Learnt**

This section aimed at reviewing different methods employed in literature. We found that time series data has to be subjected to unit root, cointegration and error correction

test when dealing with health expenditure data. The Augmented Dickey Fuller and Phillip Perron unit root test were the most popular and the Johanssen test was mostly used when doing cointegration test. This study's main focus is on the demographic and epidemiological transitions effect on health expenditure in Namibia, which warrants the importance of looking at other factors cited in literature that may be determinants of health expenditure in different countries. Factors such as demographic and epidemiological transitions; technological progress; risk factors such as smoking, unhealthy eating, alcohol consumption, and lack of physical activity; income; treatment practices; and prices, GDP per capita, private health care expenditures, public health care expenditures, total life expectancy, female mortality rate, proportion of population between 14 and 65 and urban population and health productivity were identified as some of the variables that could have an effect on health expenditure. Our literature review confirms the strong correlation between major health expenditure variables and health outcomes. It appears from literature that the variables and their effects on health expenditure may be different for each country. Due to this, it is important to analysis the effects of demographic and epidemiological factors effect on health expenditure in Namibia.

## **CHAPTER FOUR**

### **METHODOLOGY**

#### **4.1 Introduction**

Chapter Three surveyed theoretical and empirical literature on the effects of demographic and epidemiological health outcomes on health expenditure. Descriptive statistic was used to evaluate the first objective in the study. The last objective was captured within the framework of vector auto regressive analysis. This chapter summarises the methodology and techniques applied in analysing the effects of health outcomes on health expenditure in Namibia. The chapter is divided into three Sections: Section 4.2 outlines the specification of the model used in the analysis, Section 4.3 discusses issues pertaining to data sources and definition of variables, and the analytical (econometric) framework is presented in Section 4.4.

#### **4.2 Model Specification**

The relationship between demographic and epidemiological health outcomes and health expenditure was analysed by means of a VAR framework. This was justified on the ground that there is a possibility of feedback effect between health outcomes and health expenditure. In this case, modelling health outcomes and health expenditure within a single equation approach is fundamentally flawed. Hence we proposed a more robust econometric technique that treats all variable as endogenous within a dynamic structure. A variant of Fazoranti (2015) model was adopted in this study. The following

model was specified for this study to analyse the effects of health outcomes on health expenditure.

$$HE = f(IMR, LE, HIV, TB, GDP) \dots\dots\dots 4.1$$

In a multiple linear regression form, Equation (4.1) becomes;

$$HE = \beta_0 + \beta_1IMR + \beta_2LE + \beta_3HIV + \beta_4TB + \beta_5GDP + u \dots\dots\dots 4.2$$

To ensure linearity of the results and to show elasticities, the equation was expressed in logarithm form.

$$\ln HE = \beta_0 + \beta_1\ln IMR + \beta_2\ln LE + \beta_3\ln HIV + \beta_4\ln TB + \beta_5\ln GDP + u \dots\dots\dots 4.3$$

Where:

$\ln HE$  = logarithm value of total health expenditure, (% of GDP)

$\ln IMR$  = logarithm value of infant mortality, (per 1000 births)

$\ln LE$  = logarithm value of life expectancy at birth, total (years)

$\ln HIV$  = logarithm value of prevalence of HIV, total (% of population ages 15 – 49)

$\ln TB$  = logarithm value of incidence of tuberculosis, (per 100 000 people)

$\ln GDP$  = logarithm value of Gross Domestic Product per capita, (constant LCU)

$u$  = Refers to the error term.

$\beta_0$  &  $\beta_i$  = Stands for the constant term and coefficients respectively.

### 4.3 Measurement and Variable Definition

This study relies on secondary sources of data for the period 1990-2014. Annual time series data was obtained from various sources such as, World Development Indicators (WDIs), World Bank, Namibia Statistics Agency (NSA) and the Ministry of Health and Social Services (MoHSS) publications.

The health outcomes in this study are presented under two broad categories: demography and epidemiology. One of the most frequently used demographic health outcome in literature is infant mortality (Anyawu & Erhijakpor, 2009) which is defined as the number of infants dying before reaching one year. Infant mortality can decrease due to an increase in health expenditure which indicates that volumes of resources are flowing into the health sector. The coefficient  $\beta_1$  is therefore expected to have a negative sign.

Life expectancy refers to how long a person is expected to live a healthy life, based on their birth year, present age and gender. If marginal increments in health status lead to an increase in health expenditure, then the government has to spend more on health in order to make people live longer. This means  $\beta_2$  is expected to have a positive sign.

The epidemiological factors in this study include prevalence of HIV and incidence of tuberculosis. Prevalence of HIV refers to the percentage of people between the ages of 15-49 that are infected with HIV. Prevalence of HIV in Namibia was last measured at 16% in 2014 (World Bank, 2014). We expect prevalence of HIV to have a positive effect on health expenditure in Namibia.



Incidence of tuberculosis is defined as the estimated number of new pulmonary, smear positive, and extra-pulmonary tuberculosis cases. The incidence of tuberculosis (per 100 000 people) in Namibia was last measured at 561 per 100 000 people in the year 2014 (World Bank, 2014). Challenges exist at the local level regarding rising costs of increasingly complex tuberculosis treatment and care (Yip & Bekemeier, 2016). Hence, the incidence of tuberculosis is expected to have a positive effect on health expenditure.

GDP measures the income level of a country. A country's ability to spend on health depends on the level of its income. The variable was applied by Xu, Priyanka and Alberto (2011). The parameter for this variable  $\beta_5$  is expected to have a positive sign because increases in GDP generally lead to increased health expenditure. Consequently, governments will spend a larger share of their budget on health when more resources are available.

#### **4.4 Descriptive and Correlation Analysis**

The study uses quantitative techniques to analyse the data. For data treatment, variables are tested for stationarity by employing the Augmented Dickey-Fuller unit root test. The Johansen procedure is also used to test for cointegration among the variables and the short run dynamics are tested using the Vector Error Correction Model (VECM).

#### 4.4.1 Unit Root Test

The time series properties of the data employed in the study are first carried out to determine whether the series are stationary. According to Imuoghele and Ismaila (2013) most time series data are non-stationary and using them in the model might lead to spurious regression. It is important to note that the time series properties of the data set employed in the estimation of Equation 4.3 are ascertained to avoid the problem of spurious regression. Equation 4.4 expresses the general model used in testing for the presence of a unit root.

$$\Delta y_t = \alpha_0 + \delta y_{t-1} + \sum_{i=1}^p \alpha_i \Delta y_{t-1} + u_t \dots\dots\dots 4.4$$

Where  $y$  is the series and  $t$  is (trend factor):  $\alpha_0$  and  $\alpha_1$  are vectors of deterministic term (constant or trend),  $\delta$  is the parameter to be examined,  $p$  is the lag order,  $\Delta y_{t-1}$  are used to approximate the Autoregressive-Moving-Average (ARMA) model structure of the errors and  $u_t$  is the error term. The Augmented Dickey Fuller unit root test is employed to test the integration level. The value of  $p$  is set so that  $\varepsilon_t$  the error is serially uncorrelated. The error term is also assumed to be homoscedastic. The specification of the deterministic terms depends on the assumed behaviour of under the alternative hypothesis of trend stationarity as described in the previous section. Under the null hypothesis,  $y_t$  is  $I(1)$  which implies that  $\delta = 1$ .

#### 4.4.2 Cointegration Test

In the presence of unit roots, we test for cointegration of the variables to capture the long run equilibrium relationship (Angko, 2013). According to Aremu (2009) the fundamental assumption when experimenting with cointegration is that the variables are integrated of the same order. When all the variables are I(0) (stationary) series, VAR model will be estimated at levels. If the variables are I(1), the next step is to test whether they are cointegrated. And if they are I(1) and cointegrated, the error correction term has to be included in the VAR. The model becomes vector error correction model (VECM). If there are no cointegrated vectors in the system then it becomes necessary to use the VAR model in first difference. A Johansen cointegration technique was employed for cointegration test. This study adopted the maximum likelihood test procedure;

$$y_t = \alpha_0 + \sum_{j=1}^k \beta_j y_{t-j} + \gamma_j \sigma_t + u_t \dots\dots\dots 4.5$$

Where  $y_t$  is an  $n \times 1$  vector of variables that are integrated of order commonly denoted (1).  $\alpha_0$  Is the constant term,  $k$  is the number of lags,  $\beta_j$  is a vector of coefficients,  $\gamma_j$  is the deterministic term and  $\sigma_t$  is the volatility series and  $u_t$  is vector of error terms.

To use the Johanssen test, the VAR model needs to be transformed into a VECM model, by differentiating;

$$\Delta y_t = C + \sum_{j=1}^k \beta_j y_{t-j} + \Pi y_{t-k} + \gamma_j \sigma_t + u_t \dots\dots\dots 4.6$$

$$\Pi = -I + \sum_{j=1}^k \beta_j$$

Where  $\Delta$  is the first difference operator,  $I$  is an  $n \times n$  identity matrix,  $y_t$  is a vector of non-stationary variables,  $\gamma_j$  is the deterministic term,  $k$  is the number of lags and  $C$  is the constant term. The long run coefficient matrix  $\Pi$  is decomposed as  $\Pi = \alpha\beta$  where the relevant elements  $\alpha$  matrix are adjusted coefficients and the  $\beta_j$  matrix contains cointegrating vectors.  $u_t$  Is the white noise error vector.

Two statistic tests were used to determine the number of co-integration vectors, the first test is the Trace test ( $\lambda$  trace). It tests the null hypothesis that the number of distinct co-integrating vector is less than or equal to  $q$  against a general unrestricted alternative  $q = r$ . Thus;

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^p \ln(1 - \hat{\lambda}_i) \dots \dots \dots 4.7$$

$T$  is the number of usable observations, and  $\hat{\lambda}_i$  are the  $i$ th largest canonical correlation,  $r$  and  $p$  are cointegrating vectors. The second statistical test is the maximum Eigen value test ( $\lambda$  max) that is calculated according to the following formula;

$$\lambda_{max}(r, r + 1) = -T \ln(1 - \lambda_{r+1}) \dots \dots \dots 4.8$$

The maximum eigenvalue test tests the null hypothesis of  $r$  cointegrating vectors against the alternative hypothesis of  $r + 1$  cointegrating vectors. The Trace test shows more robustness to skewness than Eigen value test.

### 4.4.3 Error Correction Model (ECM)

A VAR model of order  $p$  can be represented in the following equation;

$$X_t = A_1 X_{t-1} + \dots + A_p X_{t-p} + u_t \dots\dots\dots 4.9$$

Where  $X_t$  is an  $(K \times 1)$  vector of dependent variables,  $A_i$  is  $(K \times K)$  coefficient matrix and  $\varepsilon_t$  is  $(K \times 1)$  vector of unobservable error term, which is usually time invariant and with zero mean and a positive definite covariance matrix i.e.  $E(\varepsilon_t \varepsilon_t') = \Sigma$ .

Equation 4.9 is unable to accommodate trended variables. In this case a VECM of the following form is more appropriate;

$$\Delta X_t = \Pi X_{t-1} + \Gamma_1 \Delta X_{t-1} + \dots + \Gamma_{p-1} \Delta X_{t-p+1} + u_t \dots\dots\dots 4.10$$

Where  $\Delta$  is the difference operator,  $X_t$  is an  $(K \times 1)$  vector of dependent variables,  $u_t$  is the white noise error term which is independently and identically distributed with zero mean and constant variance,  $\Gamma_i$  and  $\Pi$  are  $(n \times n)$  matrices of the parameters with  $\Gamma_i = -(I - A_1 - A_2 \dots - A_i)$ , where  $i = 1, \dots, k - 1$  and  $\Pi = -(I - A_1 - A_2 \dots - A_k)$ .

Results from VAR models are sensitive to the lag length and the ordering of variables in the VAR equation, hence special attention was paid to these two aspects. An application of Akaike's Information Criterion (AIC) and Schwartz Information Criterion (SIC) permits the identification of the optimal lag length, thus avoiding

arbitrariness in the choice of lag length while economic theory was our guide in the ordering of variables.

## **CHAPTER FIVE**

### **EMPIRICAL FINDINGS**

#### **5.1 Introduction**

This chapter presents the estimated results based on the empirical model specified in Chapter Four. The objectives of the study are captured by implementing econometric techniques. Thus, time series properties of the data (unit root test and cointegration) are used. Subsequently, we proceeded to examining causality between health expenditure and health outcomes within a VECM structure. Finally, the model efficiency was employed.

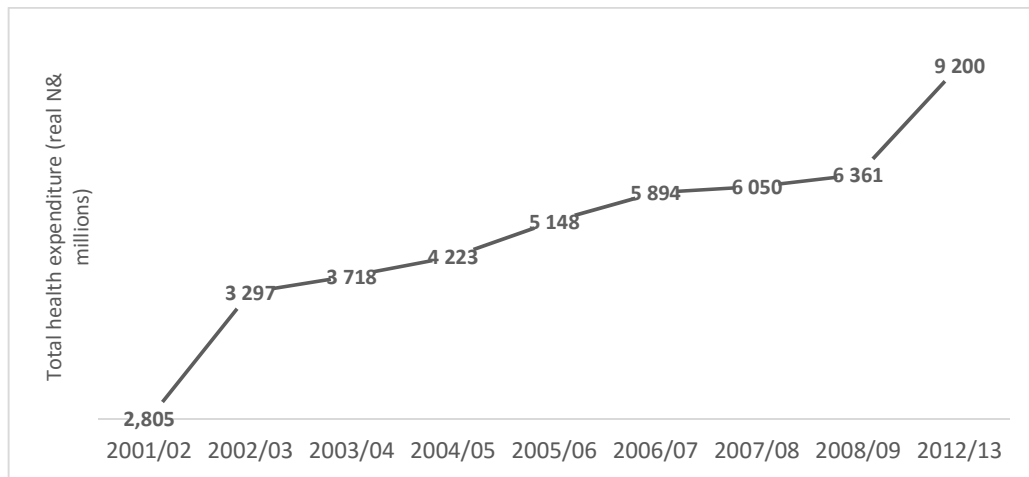
#### **5.2 Trend of Health Expenditure in Namibia 1990 – 2014**

Health expenditure as a percentage of GDP has increased from 3.3% in 1993 to 4.3% in 1999 and 9% in the year 2014, respectively. The increase in health expenditure was partially attributed to health outcomes such as HIV/AIDS and a growing population with increasing life expectancies.

Figure 5.1 shows the Ministry of Health and Social Services (2015) total health expenditure trends over the years. According to the Ministry of Health and Social Services (2015), in real 2012/13 Namibian dollars, total health expenditure grew from N\$2.8 billion in 2001/02 to N\$9.2 billion in 2012/13, an average increase of more than 12% per year. Similarly, total health expenditure as a percentage of GDP dropped to 7% in 2007/08 and 2008/09 financial years, and then increased in the 2012/13 financial

year to a peak of 9%. GDP growth in absolute terms in some years may have compensated for the lower percentage of total health expenditure (Ministry of Health and Social Services, 2015).

**Figure 5.1: Growth of Total Health Expenditure, (real 2012/13 N\$ millions)**



Source: Ministry of Health and Social Services (2015)

### **5.3 Descriptive Statistics and Correlation Matrix of Variables under Consideration**

#### **5.3.1 Unit Root Test**

All the variables in the model were subjected to stationarity tests to avoid spurious regression. The Augmented Dickey Fuller tests the null hypothesis of unit root in the series. It reports test statistics which are compared to McKinnon Critical values. The rule-of-thumb is that the null hypothesis of unit root in the series cannot be accepted if Augmented Dickey Fuller exceeds the critical value, and if the test statistics do not exceed critical value, then null hypothesis of unit root in the series cannot be rejected



and the series is said to be nonstationary. A variable is stationary (contains no unit root) if the Augmented Dickey Fuller is less than the conventional 5% critical value (Agbatogun & Taiwa, 2010). The conventional method of Augmented Dickey Fuller test was employed in this study, this is illustrated in Table 5.1.

Using unit root test, variables were tested by comparing the Augmented Dickey Fuller test critical values with the t-critical values at 1%, 5% and 10% level of significance. This was done by taking into account the trend and intercept. The following assumptions were used:

- ✓ ***H0***: Variables are non-stationary {Unit root}
- ✓ ***H1***: Variables are stationary {No unit root}

If Augmented Dickey Fuller test critical is greater than the test statistics at 1%, 5% or 10 % respectively, we reject the  $H_0$ , and conclude that the variables are stationary, meaning that there's no unit root. Similarly, if the Augmented Dickey Fuller test critical value is less than the test statistics at 1%, 5% or 10% respectively, we fail to reject the  $H_0$  and conclude that the variables are non-stationary, meaning that there's unit root.

**Table 5.1: Augmented Dickey Fuller Unit Root Test First Difference (constant and level)**

<b>Variables</b>	<b>Test Statistics</b>	<b>5% Critical value</b>	<b>First Difference</b>	<b>Remarks</b>
<b>lnHE</b>	-6.272640	-3.622033	I(1)	Stationary
<b>lnGDP</b>	-4.445556	-3.622033	I(1)	Stationary
<b>lnIMR</b>	-4.807159	-3.622033	I(1)	Stationary
<b>lnLE</b>	-3.730322	-3.690814	I(1)	Stationary
<b>lnHIV</b>	-6.94741	-3.622033	I(1)	Stationary
<b>lnTB</b>	-10.19386	-3.644963	I(1)	Stationary

The results indicate that the variables infant mortality, life expectancy, HIV and tuberculosis are first difference stationary that is I(1). Consequently, they satisfy the necessary condition of constructing a cointegration system.

### **5.3.2 Lag Structure**

Before proceeding to testing cointegration and the long run relationship, an important step is conducted to establish the optimal lag length to be used in the cointegration analysis. Akaike Information Criterion (AIC) performs better than any other information criterion (Tang, 2011). Using the AIC, the optimal lag is 1 for this exercise. The results from the determination of lag length are presented in Table 5.2.

**Table 5.2: Lag Order Selection Criterion**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	231.6060	NA	2.76e-16	-18.80050	-18.50598	-18.72236
1	436.1848	289.8200*	2.42e-22*	-32.84873*	-30.78714*	-32.30179*

\* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

### 5.3.3 Cointegration Test

We test the presence of long-run equilibrium relationship using a Johanssen cointegration approach. Unlike the two-step residual-base Engle and Granger Bounds testing procedure, the Johanssen cointegration is not sensitive to the choice of dependent variables because it assumes that all variables are endogenous. Johanssen cointegration method detects a number of cointegrating vectors in non-stationary time series. The null hypothesis is rejected if values of the likelihood Eigen value test are greater than the critical values at a chosen level of significance.

**Table 5.3: Johanssen Cointegration Test**

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.912832	145.9926	95.75366	0.0000
At most 1 *	0.808896	89.87432	69.81889	0.0006
At most 2 *	0.641678	51.81076	47.85613	0.0203
At most 3	0.481836	28.20529	29.79707	0.0754
Trace test indicates 3 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.912832	56.11825	40.07757	0.0004
At most 1 *	0.808896	38.06357	33.87687	0.0149
At most 2	0.641678	23.60547	27.58434	0.1491
At most 3	0.481836	15.12167	21.13162	0.2805
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

The Trace test statistics strongly rejects the null hypothesis that there is no cointegrating vector present which is validated by the Eigenvalue statistics but does not reject the hypothesis that there are at most three cointegrating vectors. The Eigenvalue statistics however only found two cointegrating vectors. The Trace test performs better than the Eigenvalue better, since it appears to be more robust to skewness and excess kurtosis. Therefore, the decision was made on the basis of the Trace test. Furthermore, the Trace test can be adjusted for degrees of freedom, which can be of importance in small samples. The results from Table 5.3 indicate that there are three cointegrating vectors which implies that the variables are bounded together by a long run relationship. (Anyawu & Erhijakpor, 2009; Imuoghele & Ismaila, 2013; Tang, 2011; Taskaya & Demirkiran, 2016) found a long run relationship between health expenditure and health outcomes.

### 5.3.4 Long Run Equilibrium Relationship

The variables are expressed in logarithm form, which shows the long run elasticity. The long run results are discussed below.

$$\ln HE = 26.468 - 1.167 \ln IMR + 0.559 \ln LE + 0.134 \ln HIV + 0.234 \ln TB + 12.263 \ln GDP \dots\dots\dots 5.1$$

*t* – statistics    (0.35849)    (0.37412)    (0.06680)    (0.07021)    (2.19606)

The results from the normalized cointegrating Equation 5.1, indicate that there exists a long run relationship among the variables in the model over the sample period. Where lnHE is the dependent variable, 26.468 is the constant term, -1.167 is the

coefficient of lnIMR, 0.559 is for lnLE, 0.134 for lnHIV, 0.234 for lnTB and 12.263 is for lnGDP respectively. The signs for lnHIV, lnTB, lnLE and lnGDP conform to economic theories i.e. the coefficients exhibits a positive and significant long run relationship. The long run relationship between lnIMR and lnHE is however negative. The results reveal that in the long run, demographic and epidemiological health outcomes have significant impact on health expenditure. Given that the variables are cointegrated, VAR model in VECM structure is specified.

### 5.3.5 The Vector Error Correction Model (VECM)

The VECM was designed for use with non-stationary series that were known to be cointegrated. The VECM has cointegration relations built into the specification so that it restricts the long run behaviour of the endogenous variables to converge to their cointegrating relationship while allowing for short-run adjustment dynamics. The cointegration term is known as the Error Correction Term (ECT) since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. The short run and long run causal relationship between the variables should be examined in a VECM framework and the results of the estimated model are presented in Table 5.4. HE in its detailed form for constrained VECM can be computed by the following equation;

$$\Delta \ln HE = \beta_0 + \beta_1 \Delta \ln IMR + \beta_2 \Delta \ln LE + \beta_3 \Delta \ln HIV + \beta_4 \Delta \ln TB + \beta_5 \Delta \ln GDP + \beta_6 ECM_{t-i} + \mu \dots \dots \dots 5.2$$

$ECM_{t-i}$  Represents the deviation from equilibrium in period t and the coefficient  $\alpha$  characterises the response of the dependent variable HE in each period to departures from equilibrium.  $\Delta$  Is the differencing operator and all the variables are  $I(0)$  in their natural log. The existence of the long-run relations between the variables is determined through testing the significance of the lagged levels of the variables.

The VECM results presented below show that all the explanatory variables have a relationship with the dependent variable according to the a priori expectation and the model satisfies the stability condition, that is, the ECT in the model should have the required negative sign and lie within the accepted region of less than unity. The ECT has the expected negative sign and is statistically significant. Its value of (-0.374659) i.e. 37% shows that the disequilibrium in health expenditure in the previous year is corrected in the current period. These results demonstrate that the explanatory variables go a long way in explaining health expenditure in Namibia. Taking into consideration the degree of freedom, the adjusted R-squared shows that only about 4% of the dependent variable is explained by the explanatory variables. The computed coefficient of multiple determination ( $R^2$ ) value of 0.290797 indicated that the model satisfies the requirements for goodness of fit. Thus, 29% of the total variation in health expenditure (HE) is accounted for, by the explanatory variables [infant mortality rate (IMR), life expectancy (LE), prevalence of HIV (HIV) and incidence of tuberculosis (TB)]. While 71% of the changes in health expenditure is attributable to the influence of other factors not included in the regression equation.

**Table 5.4: Error Correction Model Estimation**

Vector Error Correction Estimates						
Error						
Correction:	D(LNHE)	D(LNIMR)	D(LNLE)	D(LNHIV)	D(LNTB)	D(LNGDP)
D(LNHE(-1))	-0.095358 (0.33638)	-0.034867 (0.06789)	0.074719 (0.04530)	0.295180 (0.40971)	-0.229337 (0.17356)	0.013267 (0.01673)
					[-	
						[-0.28349] [-0.51361] [ 1.64960] [ 0.72047] 1.32137] [ 0.79292]
	-					
D(LNIMR(-1))	0.311336 (1.05132)	-0.431526 (0.21217)	-0.100093 (0.14157)	-0.265681 (1.28050)	-0.678773 (0.54245)	0.011793 (0.05229)
		[-			[-	
						[ 0.29614] 2.03383]* [-0.70704] [-0.20748] 1.25132] [ 0.22551]
D(LNLE(-1))	0.920294 (1.57577)	-0.388000 (0.31802)	0.217446 (0.21219)	-0.292513 (1.91928)	0.940333 (0.81305)	0.022294 (0.07838)
						[-0.58403] [-1.22006] [ 1.02478] [-0.15241] [ 1.15656] [ 0.28443]
D(LNHIV(-1))	-0.104493 (0.15407)	0.009315 (0.03109)	-0.043481 (0.02075)	0.349503 (0.18766)	0.009369 (0.07950)	0.007229 (0.00766)
						[-
						[-0.67820] [ 0.29957] 2.09574]* [ 1.86241] [ 0.11785] [ 0.94325]



D(LNTB(-1))	0.860448	-0.267495	0.179721	-0.233457	-0.007447	-0.034750
	(0.61266)	(0.12364)	(0.08250)	(0.74622)	(0.31611)	(0.03048)
		[-			[-	
	[ 1.40445]	2.16341]*	[ 2.17848]*	[-0.31285]	0.02356]	[-1.14027]
D(LNGDP(-1))	4.865412	-0.915852	1.520568	1.002011	1.724027	0.139078
	(5.32923)	(1.07553)	(0.71761)	(6.49098)	(2.74972)	(0.26509)
	[ 2.91297]	[-0.85154]	[ 2.11892]*	[ 0.15437]	[ 0.62698]	[ 0.52465]
C	-0.016405	-0.007790	-0.008966	0.032235	0.017097	0.002707
	(0.03002)	(0.00606)	(0.00404)	(0.03656)	(0.01549)	(0.00149)
	[-0.54654]	[-1.28599]	[-2.21826]	[ 0.88173]	[ 1.10396]	[ 1.81330]
ECT	-0.374659	0.160141	-0.074752	0.205485	0.443566	0.008736
	(0.25442)	(0.05135)	(0.03426)	(0.30988)	(0.13127)	(0.01266)
	[-2.47262]	[ 3.11889]	[-2.18197]	[ 0.66312]	[ 3.37901]	[ 0.69027]
<b>R<sup>2</sup></b>	0.290797	0.810575	0.832755	0.682443	0.952523	0.276820
Adj. R-squared	-0.040164	0.722176	0.754707	0.534250	0.930367	-0.060663

*Standard errors in ( ) and t-statistic in [ ], the \* indicates significance at 5% level*

### 5.3.6 Model Efficiency

It is extremely important to critically examine the properties of the regression models.

A good regression model is one that has a high R<sup>2</sup> value, no serial correlation, no

heteroscedasticity in the residuals and the residuals are normally distributed. We conduct a statistical test for normality (Jarque-Bera statistic), Breusch-Godfrey test for serial correlation, and the Autoregressive Conditional Heteroscedasticity (ARCH). The results show that there is serial correlation within the model; this can be removed by using first differenced variables. Table 5.5 shows some descriptive statistics of health outcomes and health expenditure imported from the Eviews software. The series are said to be negatively skewed and the kurtosis is more than the normal distribution kurtosis of 3. The Jarque-Bera test is performed in order to check the normality of each series, the results confirm that the distribution is normal. We therefore can accept the null hypothesis of the residuals being normally distributed as the P-value is more than the 5% critical value. There is no serial correlation, therefore, our model is acceptable. For a model to be efficient it should not have serial correlation, no ARCH effect and residuals must be normally distributed.

**Table 5.5: Diagnostic Tests**

<b>Diagnostic test</b>	<b>R squared</b>	<b>Probability</b>
<b>Breusch-Godfrey serial correlation LM test</b>	1.816968	0.2026
<b>ARCH test- heteroscedasticity</b>	0.531299	0.4745
<b>Jarque-Bera statistics</b>	2.843833	0.2413

## 5.4 Discussion

It can be deduced that a year lag value of (lnHE -1) impacts positively on current year health expenditure. This was however not significant at 1% level. The variable (lnGDP -1) has positive and significant effect on health expenditure with a coefficient of 4.87. This implies that a 1% increase in GDP will lead to a 4.87% increase in health expenditure. This finding is consistent with (Abbas & Hiemenz, 2011; Imuoghele & Ismaila 2013; Omotor, 2009) in their studies of the determinants of health expenditure. The low value of the variable is a pointer to the fact that income in Namibia is not equitably distributed. The implication of this study is that the elasticity of more than unity of the variable indicates that health expenditure in Namibia is a luxury good. This finding is consistent with Anyawu and Erhijakpor (2009) study.

A year lag value of the coefficient (lnIMR -1) had a negative sign. This finding is consistent with Anyawu and Erhijakpor (2009). This is in line with the a priori expectation that shows that a 1% increase in infant mortality will lead to a 0.31% increase in health expenditure in Namibia. This shows that government's attention to reducing the infant mortality rate yielded desired results. Given that the Ministry of Health and Social Services takes up the largest portion of government revenue, Namibia has continuously recorded a tremendous decline in infant mortality over the past years. This achievement is accompanied by many efforts such as the transformation of clinics into primary health centres fitted with two to four maternity beds, especially in rural areas. However, more still needs to be done as the efforts are not strong enough to make meaningful impact as the variable was not statistically significant.

The coefficient (lnLE -1) has a positive sign and insignificant effect on health expenditure. This result is consistent with the a priori expectation (Khan, Razali & Shafie, 2016; Mahumud et al., 2013) who found a positive relationship between life expectancy and health expenditure. The value of the coefficient is 0.92. This implies that a 1% increase in life expectancy will lead to 0.92% increase in health expenditure. Despite Namibia spending millions of dollars in construction and upgrading of health facilities, the life expectancy of Namibians remains low due to factors such as car accidents, HIV/AIDS and passion killings. This could be due to the average per capita spending which is high but the average does not tell us about how much each individual in Namibia receives. Thus, the results could imply that other measures to improve the life expectancy should be used or resources should be channelled towards health outcomes such as infant mortality and HIV in order to bring about significant improves.

The coefficient of the variable (lnHIV -1) bears a negative sign. This finding is consistent with Kamiya (2010) which indicate that HIV has no significant effect on health expenditure in Namibia. This result implies that there is a negative relationship between HIV and health expenditure in Namibia. The value of the coefficient of HIV is -0.10. A 1% increase in prevalence of HIV will lead to 0.10% decrease in health expenditure. This finding is a pointer to the fact that the Namibian health sector falls short in providing adequate health expenditure which relies heavily on donor funding. Furthermore, health expenditure alone is not enough to reduce the prevalence of HIV in Namibia. This underscores the importance of the health system and other non-expenditure factors to facilitate the attainment of this health outcome.

The estimated coefficient of the incidence of tuberculosis ( $\ln TB - 1$ ) bears a positive sign and has an insignificant relationship with health expenditure. Xu, Priyanka and Alberto (2011) also found a positive, but only marginally significant relationship between incidence of tuberculosis and health expenditure. The value of the coefficient is 0.86. The results from this study imply that a 1% increase in tuberculosis will lead to 0.204% increase in health expenditure. Control of tuberculosis, like any other health outcome in general, costs money. One would say, the investments made by the government to reduce this health outcome such as national tuberculosis programme staff, drugs, laboratory supplies and primary health-care staff and infrastructure, paid off. Namibia has made tremendous strides in reducing the incidence of tuberculosis over the years. However, according to Xu, Priyanka and Alberto (2011) increased resources may mainly be reflected in external aid through disease programs. Hence, the insignificance of the variable.

Looking beyond 2014 in pursuit of Namibia's Harambee Prosperity Plan, health expenditure is expected to rise at a steady rate. Health expenditure projection from 2014-2023 shown in Appendix A, reveal that health expenditure in Namibia will continue to rise steadily maybe as a result of fertility rate and incidence of tuberculosis as well as other factors which might include loss of value of the Namibian Dollar among other factors and the current economic crisis brewing in the country.

### **5.5 Limitations of the Study**

This study considers only variables such as per capita GDP, life expectancy, infant mortality, incidence of tuberculosis and prevalence of HIV due to unavailability of

data from 1984 to 2014 for some demographic and epidemiological health outcomes such as age dependency ratio, crude death rate and urbanization in Namibia. Incidentally, inconsistency in data is the main limitation of this study since the data were extracted from different sources.

## CHAPTER SIX

### CONCLUSION, IMPLICATIONS FOR POLICY AND RECOMMENDATIONS

#### 6.1 Summary of Main Findings

The broad objective of the study was to determine the relationship between health expenditure and demographic and epidemiological health. Thus, the study formulated an econometric model to investigate the effects of demographic and epidemiological health outcomes; infant mortality, life expectancy, HIV, tuberculosis and GDP on health expenditure, based on annual data from 1990 to 2014.

The results from the study indicate that total health expenditure (% of GDP) is integrated of order one,  $I(1)$  and cointegrated with all the other explanatory variables. Subsequently, cointegration analysis and VECM were employed to detect possible long run and short run relationships between health expenditure with infant mortality, life expectancy, HIV and tuberculosis. In addition, long run relationships exist between health outcomes and health expenditure. From error correction model, only the variable GDP was found to be significant to health expenditure, however, the rest of the variables, i.e. Infant mortality, life expectancy, HIV and tuberculosis were insignificant. Life expectancy, tuberculosis and GDP showed a positive relationship with health expenditure, whilst infant mortality and HIV were negative. The speed of adjustment of health expenditure to the long run equilibrium path is relatively low.

Conclusively, demographic and epidemiological health outcomes have an effect on the health expenditure, although insignificant to the overall economy. It should be noted that working with times series data brings a lot of restriction with regards to the sample size and the accuracy of the asymptotic test.

## **6.2 Implications for Policy**

Health expenditure is not sufficient and equitable in improving health outcomes. While resources are geared towards improving health, policymakers must keep in mind that the intended goal is to bring about significant improvements in health outcomes. Resources must be geared towards health outcomes that significantly affect health expenditure. GDP was found to be significant to health expenditure, therefore a high GDP means that more investments can be geared towards health in Namibia. Policies that create a conducive environment for investors and maintain a stable economy are essential for providing better health and in turn improving health outcomes in Namibia.

Attention should be shifted to funding non-communicable diseases. Since HIV was found to be insignificant to health expenditure, it is essential for the government to mobilize domestic resources to fill the HIV/AIDS funding gap by allocating more resources to HIV/AIDS and by integrating HIV/AIDS services into other health services to increase efficiency. Spending in Namibia is skewed towards secondary and tertiary curative care. This calls for a closer investigation of cost efficiency and resource allocation decisions.



Policies should also be directed towards health outcomes that can be improved with higher spending. The results from the study show that an increase in health expenditure can reduce infant mortality and HIV and increase life expectancy.

It is important to analyse how the health outcomes impacted on health expenditure in bringing about progress. The transition of health outcomes could be about increments in health spending. Funds alone, however, are not a panacea. Instead health outcomes need strategic planning, commitment, outreach, and other non-financial resources, e.g., time and efficiency to be successful. A key role for policy is the provision of both financial and non-financial resources.

### **6.3 Areas for Future Research**

We still need more macroeconomic theories on health and health expenditure in Namibia. It will be interesting to analyse demographic and epidemiological outcomes at the micro level (individual level analysis). More research is needed to understand the role of population increases and urbanisation on disease patterns and on micro social processes such that the interrelationship between changing lifestyles, diet, and over nutrition across all social classes is analysed in Namibia. It is important that future research addresses the issue of communicable and non-communicable diseases as potentially interrelated and mutually reinforcing.

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**APPENDIX A: TIME SERIES PROJECTIONS (2017-2023)**

Year	health expenditure, total (% of GDP)	1	2	3	4	5	6
		x- code	4-q.m.a	Centred	%	Depersona lised	
1984	5.001193	1					4.93
1985	5.100415	2					5.09
1986	5.201605	3	5.15	5.203111	99.97		5.19
1987	5.304804	4	5.25	5.306339	99.97		5.38
1988	5.410049	5	5.35	5.411615	99.97		5.28
1989	5.517383	6	5.46	5.51898	99.97		5.51
1990	5.626846	7	5.57	5.628475	99.97		5.62
1991	5.738481	8	5.68	5.740142	99.97		5.83
1992	5.852331	9	5.79	5.854025	99.97		5.77
1993	5.968439	10	5.91	5.970167	99.97		5.96
1994	6.086851	11	6.02	6.119446	99.46		6.08
1995	6.207612	12	6.21	6.31941	98.23		6.30
1996	6.57743	13	6.42	6.522478	100.84		6.48
1997	6.843055	14	6.61	6.711638	101.95		6.83

1998	6.836775	15	6.80	6.749131	101.29	6.83
1999	6.970969	16	6.69	6.608205	105.48	7.08
2000	6.114016	17	6.52	6.441542	94.91	6.02
2001	6.179062	18	6.35	6.30201	98.04	6.17
2002	6.167464	19	6.24	6.290888	98.03	6.16
2003	6.52403	20	6.33	6.478089	100.70	6.62
2004	6.471976	21	6.62	6.749523	95.88	6.38
2005	7.318711	22	6.87	6.927741	105.64	7.31
2006	7.199287	23	6.97	7.058481	101.99	7.19
2007	6.917946	24	7.13	7.243034	95.51	7.02
2008	7.123983	25	7.34	7.440757	95.74	7.02
2009	8.143129	26	7.53	7.743249	105.16	8.13
2010	7.956653	27	7.95	8.054946	98.77	7.94
2011	8.580519	28	8.15			8.71
2012	7.954981	29				7.84
2013	7.737475	30				7.73

### Summary Table

<b>Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>4</b>
1984 - 1987			99.97	99.97	
1988	-				
1991	99.97	99.97	99.97	99.97	
1992	-				
1995	99.97	99.97	99.47	98.23	
1996	-				
1999	100.84	101.96	101.3	105.49	
2000	-				
2003	94.92	98.05	100.71	95.89	
2004-2007	105.64	101.99	95.51	95.74	
2008-2011	105.16	98.78			
Unadjusted	101.49	100.17	100.18	98.52	400.36
Factor	0.9991	0.9991	0.9991	0.9991	
Typical					
Index	101.4	100.08	100.09	98.43	400

$$\text{factor} = 400/400.36 = 0.9991$$



	y	x-code	xy	x <sup>2</sup>
1984	5.001193	1	5.001193	1
1985	5.100415	2	10.20083	4
1986	5.201605	3	15.60482	9
1987	5.304804	4	21.21922	16
1988	5.410049	5	27.05025	25
1989	5.517383	6	33.1043	36
1990	5.626846	7	39.38792	49
1991	5.738481	8	45.90785	64
1992	5.852331	9	52.67098	81
1993	5.968439	10	59.68439	100
1994	6.086851	11	66.95536	121
1995	6.207612	12	74.49134	144
1996	6.57743	13	85.50659	169
1997	6.843055	14	95.80277	196
1998	6.836775	15	102.5516	225
1999	6.970969	16	111.5355	256
2000	6.114016	17	103.9383	289
2001	6.179062	18	111.2231	324
2002	6.167464	19	117.1818	361
2003	6.52403	20	130.4806	400
2004	6.471976	21	135.9115	441
2005	7.318711	22	161.0116	484
2006	7.199287	23	165.5836	529

2007	6.917946	24	166.0307	576
2008	7.123983	25	178.0996	625
2009	8.143129	26	211.7214	676
2010	7.956653	27	214.8296	729
2011	8.580519	28	240.2545	784
2012	7.954981	29	230.6944	841
2013	7.737475	30	232.1243	900
Total ( $\Sigma$ )	194.6335	465	3245.76	9455

$$a = 194.6335/30 - 0.1(465/30) = 4.94$$

Thus, trend line is  $y = 4.94 + 0.1x$

Year	x-code	$4.94 + 0.1x$	
2017	34	$4.94+0.1(34)$	8.34
2018	35	$4.94+0.1(35)$	8.44
2019	36	$4.94+0.1(36)$	8.54
2020	37	$4.94+0.1(37)$	8.64
2021	38	$4.94+0.1(38)$	8.74
2022	39	$4.94+0.1(39)$	8.84
2023	40	$4.94+0.1(40)$	8.94