# Health and Economic Development in Reverse Causality

An Inaugural Lecture By
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## Summary

Intuition and scientific evidence produced in the 1980's suggest that improved income or economic growth leads to improved health of the population. As the standard of living of people improves, they tend to live healthier and longer lives. Thus, it is said that "The wealthier is the healthier"; implying that richer individuals tend to be healthier and richer nations tend to live healthier and longer lives. Part I of this paper, which forms a significant part of the author's research over the years, shows that income (wealth) affects the health of people through the socioeconomic determinants of health. The socioeconomic context creates social stratification and assign individuals to different social positions. These social stratifications or socioeconomic position in turn create differential exposure to health conditions and differential vulnerability. They also determine the differential consequences of ill-health. Economic processes and political decisions condition the private resources available and shape the nature of infrastructure, including education, health services, environment, food, and housing quality that shape the individual's level of exposure to health risks and the ability to response to health needs.

Based on the premise that health is the outcome of the economic development process, healthcare reforms over the last two and

half decades considered healthcare interventions as costs that need to be contained. The role of health in economic development was underestimated by economists who felt that the study of health and longevity were the subject of demography and epidemiology, not proper to economics.

However, Part II of this paper summarizes recent theoretical insights and empirical evidence from the endogenous economic growth models and studies using historical data showing that improved health accounts for a large proportion of economic growth. That is, health is a major determinant of economic growth. Differences in health among populations of nations account for significant differences in income per capita among nations. In other words, the relationship between health and economic growth is two-way: improved economic conditions lead to improved health and improved health leads to better economic performance at both individual and national levels. Economists now consider health as a powerful policy tool for sustained economic growth, and, as such, it has gradually moved to the center of the economic development agenda.

The paper provides a summary of research evidence of some of the major channels through which health affects economic growth and development. In particular it examines the ways health affects economic performance through the labor market channel. There is strong evidence from research that malnutrition in infancy is a central stimulus through which adult health and productivity is programmed. Scientific evidence using historical data suggest further that good health accounts for between 30-40% of national economic growth.

Part III of the paper provides a summary of the author's major contributions to literature. These are articulated under theoretical,

methodological, and empirical contributions. It also sketches an outline of the author's future research trajectory.

## Protocol

The Vice-Chancellor,
Deputy Vice-Chancellors and Principal Officers of the University
Distinguished Academics and Administrators
My Lords Spiritual and Temporal
Our Esteemed Guests
Distinguished Ladies and Gentlemen
Great Lions and Lionesses

I give honor and praise to God who has made it possible for me to stand before you, a most distinguished audience, to address you as the 99th Inaugural Lecturer in the University of Nigeria, and 3rd from the Department of Economics. The subject of this lecture is "Health and Economic Development in Reverse Causality"

### Introduction

Since my first published work titled 'Demand for Healthcare Services in Nigeria: A Nested Logit Model', (Ichoku and Leibbrandt 2003), which resulted from my MSc mini-dissertation at the University of Cape Town in 2000, my research interest has focused mainly on health and the potential role of health in economic development and income distribution. This interest broadened out and deepened in my PhD dissertation at the same university titled "A Distributional Analysis of Healthcare Financing in a Developing Country: A Nigerian Case Study Applying a Decomposable Gini Index (Ichoku 2006)

In 2009, Professor Di MacIntyre of the Health Economics Unit, and the Chair of Health and Wealth at the University of Cape

Town invited me as a post-doctoral fellow to work on a sub-theme in Health and Wealth dealing with the relationship between health and economic growth. The fellowship was made possible by a research grant from the South African National Research Foundation. This opportunity enabled me to appreciate the depth of the argument and the growing literature on the circular nature of the relationship between health and economic growth.

The first empirical research evidence beginning from the Black Report (Black et al 1980) suggests that improvements in income and general social conditions of a nation lead to improved health outcomes. This has important policy implication. If rising income and better social conditions improve health through spending on goods and services that directly or indirectly improve people's health, then an important strategy for the public decision maker is to improve the per capita income of the people.

There is also increasing realization among development economists[1] that the demand for healthcare is a derived demand, while health itself is demanded for its own sake. When people go to hospital to seek healthcare, they are not seeking healthcare for its own sake but for the sake of improvement in their health. Health is not only demanded for its own sake, it is also demanded as a crucial factor input in the economic production process, and thus, has a large potential to influence the direction of economic

[1]Development Economics is the branch of economics discipline that deals with the economics of the development process in low-income countries. Its focus is not only on methods of promoting economic development, economic growth and structural change but also on improving the potential of the population through health and education and workplace conditions.

growth. This insight which was contained in the seminal work of Grossman (Grossman 1972) seems to have suddenly awoken interest in these later days.

Health is not only valued because of the intrinsic utility (satisfaction) that it provides as a source of wellbeing and wholeness but also because of its potential to contribute to economic growth. This view is quite novel among economists who historically consider good health as a by-product of economic advancement and prosperity not as a factor of production. Hence budget for health is not a consumption budget but an investment or capital budget. Therefore, this new relationship between health and economic growth has also far reaching implications for policy.

***The Growing Significance of Health in Economic Development***

The growing significance of health in economic development and social restructuring is reflected in its increasing importance in the global economic output of goods and services. Indeed, the global expenditure on health is one of the fastest growing sub-headings in global expenditure. The total global expenditure on health as at 2010 stood at $6.5 trillion (WHO 2012). The total revenue of the top 25 companies in the global pharmaceutical industry in 2014 was about $550 billion. (PMLiVE, 2014). These companies are expending huge sums of money in the development of new pharmaceutical products and medical technology which are also escalating the cost of healthcare.

Many developed and developing countries are spending well over 10% of their gross national product (GDP) to finance health. For example, United States of America in 2013 spent about $2.9

trillion representing about 17.4% of its total gross domestic product (GDP) on health (National Centre for Health Statistics, 2014). In the same year Germany spent 11.3% of GDP on health, France 11.7%, Netherlands 12.9%, Rwanda 11.1%, and Sierra-Leon 11.8% (WHO Database 2013). Murray and Dieleman (2014) report that in 2013, the international funding of health by donors was about $31.3 billion which is five times greater than the amount in 1990.This trend is not decreasing but indeed growing at a fast rate.

There are also huge gaps in global expenditures on health across countries and regions as illustrated in Figure 1. It shows the large variations among countries in their per capita health expenditure at international Purchasing Power Parity (PPP). It clearly shows the huge difference between US and many other African countries including Nigeria.

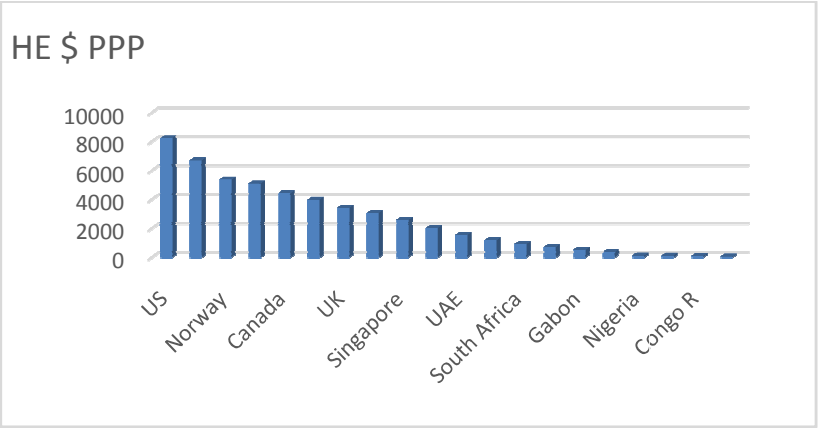


Figure 1: Per Capita Health Expenditure by Countries in 2012 (Data Source: WHO Database)

The inequalities among regions is also very huge. According to WHO Database, member countries of the Organization for Economic Co-operation and Development (OECD) that make up only 18% of the world's population spend 84% of total world health expenditure even though they bear only 8% of the world's burden of disease. The average per capita expenditure on health in Sub-Saharan Africa (SSA) is less than US$50 (at PPP). About 11% of this is accounted for by international donor agencies. Yet the region bears 59% of the world's burden of disease and Disability-Adjusted Life Years. These huge expenditures on health and healthcare reflect the increasing recognition by public decision makers that health is crucial for economic growth and economic growth is, in turn, crucial for improved health of the population.

**Some Stylized Facts about Health and Economic Development**

Figure 2 was plotted using data on per capita income and life expectancy for countries. The data were obtained from WHO Database (2012). It demonstrates the clear relationship between per capita income and life expectancy. The figure shows that at low levels of income, this relationship tends to be linear. However, as life expectancy reaches between 70 and 80 years, increases in per capita income does not seem to add more to life expectancy as the per capita-life expectancy curve becomes asymptotic to an upper threshold.

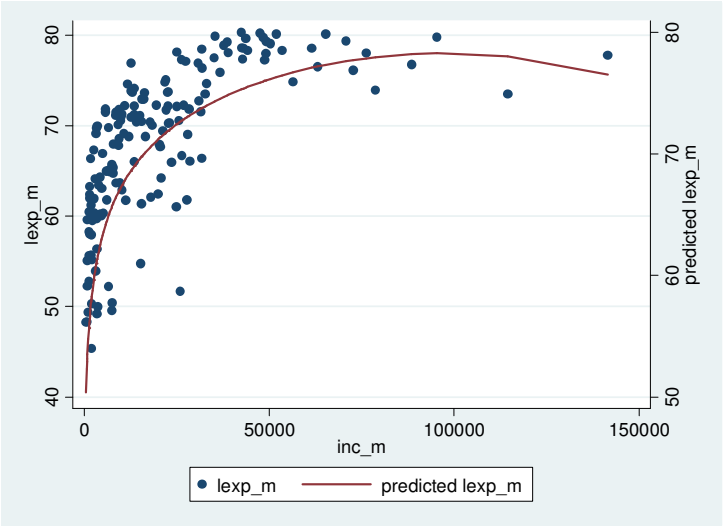


Figure 2A: The Income-Health Gradient (Data Source: WHO Database)

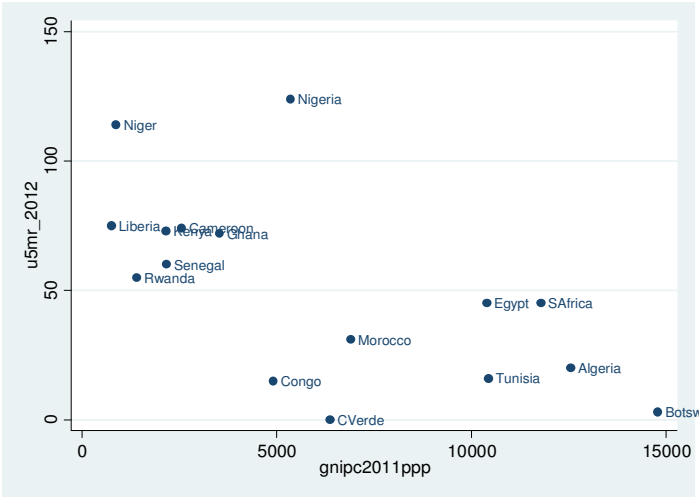


Figure 2B Income per capita and Child mortality among Selected African Countries (WHO Database2012)

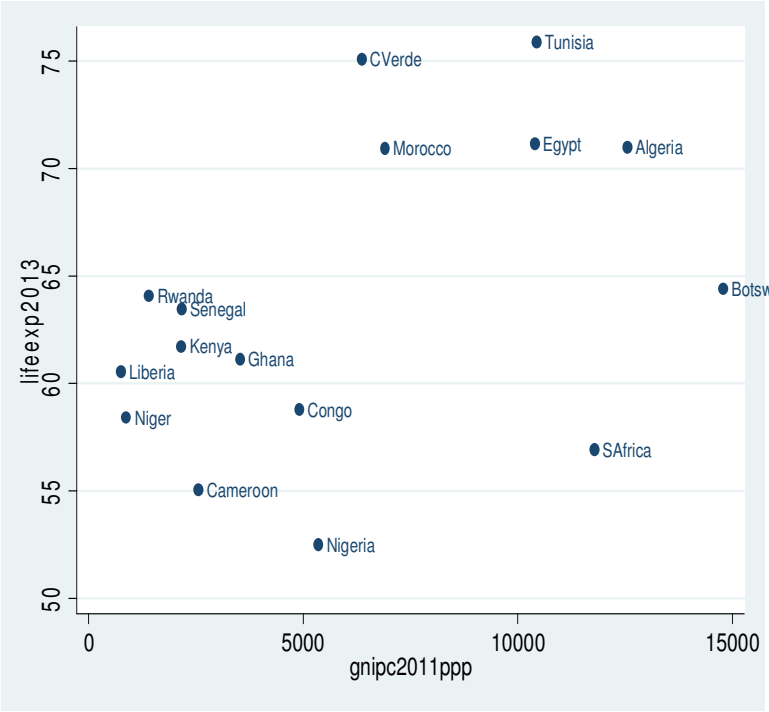


Fig 2C. Distribution of GDP Per Capita and Life Expectancy in Some African Countries(Data Source: WHO Database)

My research work over the last decade, apart from dealing with financing of health has focused mainly on identifying and analysing the economic and social determinants of health particularly from an African perspective. I have also tried to engage to some extent on the other side of the circular relationship, the role of health in economic growth (see for example Ichoku and Ifelunini, 2015). In fact I spent the whole of my postdoctoral year 2009 working on this relationship. The findings from my research over these years have made it clear to me that there is a circular relationship between health and economic development and that behind the cheerful face of healthcare as a field populated by good

Samaritans and reflecting to us the capacity of the society to care, are also powerful economic and social forces that remotely control who has access to healthcare services and who does not, who gets cured and who does not. All in all, people who are wealthier tend to be healthier.

This lecture is structured as follows. In Part I, I examine the underlying economic and social structures and processes that determine how long we live and the social determinants of health that suggest that the wealthier is the healthier. Within this section I discuss how researchers from western industrialized countries have tried to refocus research on *health economics* that emphasizes health as a social good and healthcare system as social institutions to research on *healthcare economics* that emphasizes the individual perspective within healthcare. In the second part I look at the other side of the coin: recent developments in research that show that the healthier is the wealthier or the causal relationship from health to economic growth. In Part III, I briefly summarize my contributions to literature and future research trajectory.

## Part I: The Wealthier is the Healthier

### *The Health System as a Social Institution*

The social and economic structure of society determines the income distribution and access to social services including health services. The economic structure determines who can afford healthcare costs and who cannot, who goes to private healthcare provider and who goes to public healthcare providers, whether the healthcare provider treats you with respect or not, whether you will be discharged from a healthcare facility after treatment or not. In

fact, that the critical question raised by Fuchs (1973) "Who Shall Live?" is not answered in the healthcare facility but in society whose economic and social structures create inequalities in income, education, social status, location, and, above all, power distribution and networks that create the environment which determines whether our lives will be short or long relative to another person.

However, while the structure and organization of society determines its health and the nature of its health institutions and its capacity to care, the health system, as Macintosh (2001) argues, is also a social institution built on existing social institutions and therefore mirroring, reflecting and throwing back at us the very underlying economic and social inequalities that characterise society itself. This is not to down-play the importance of the powerful immutable biological DNA we inherit at birth but it is to suggest that mortality, morbidity, life expectancy, how long we expect to live are not all about biology but more importantly about how the global economy is organized, how our society is organized, and where, when, and how we are inserted into that society. It is also not to say that Ministries of Health are not working hard enough to create equal playing ground for everyone. But their best effort is not enough. This is what creates differences and inequalities in our life expectancies, how long or how short we live. For example, in a study conducted long ago by the United Nations Development Program (UNDP 1994), it was found that average life expectancy in the old Borno state was 40 years while in the old Bendel state it was 58. That is, a difference of 18 solid years! That difference is not because fate has decreed it. It results from the nature of our economic and social organization,

individual and collective choices, conscious policy choices, and economic and social choices.

Using Data from Nigeria Demographic and Health Survey 2004[2] UNICEF, Figures 3A and 3B plot the differences across four geopolitical zones in Nigeria. Figure 3A shows that as the period, for every 1000 babies born in North West Nigeria, about 269 of them will die before their 5th birth day. The equivalent figure for the South East is 103. That is to say, that a baby born in northwest Nigeria is more than two and half times more likely to die before age 5 than her counterpart born in SE.

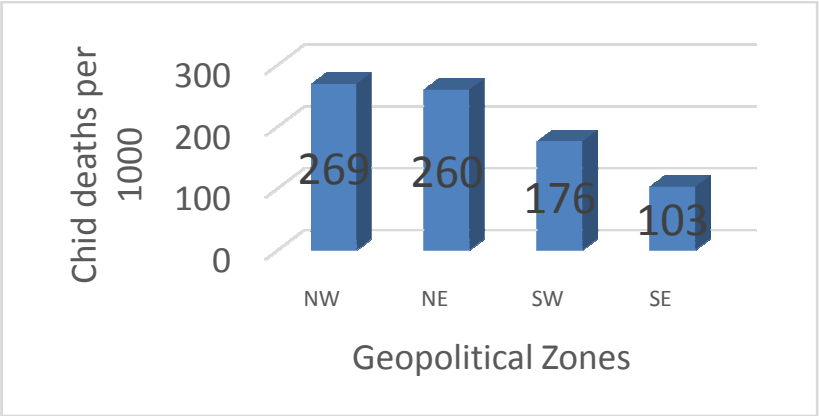


Fig 3A: Differences in Child Mortality Rates across 4 Geopolitical Zones in Nigeria (Data Source: NDHS 2004)

[2] This is the latest survey year with child and Maternal mortality rates

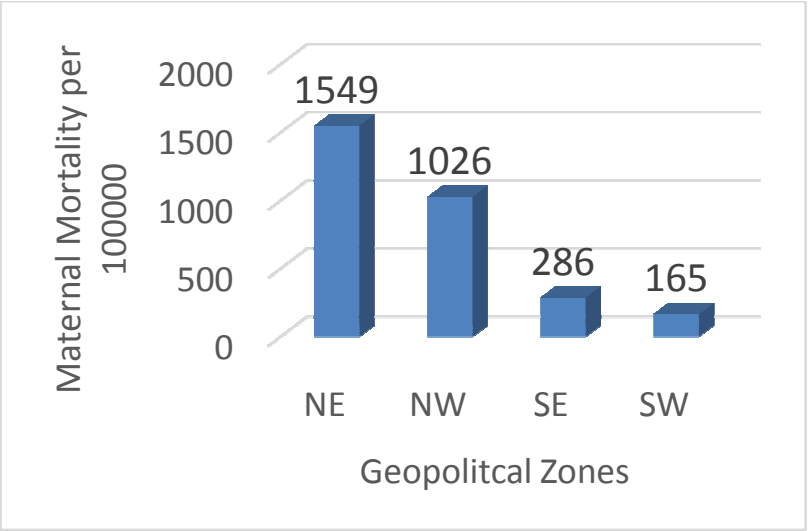


Fig 3B: Differences in Maternal Mortalities Across 4 Geopolitical Zones in Nigeria (Data Source: NDHS 2004)

Figure 3B shows the differences in Maternal Mortalities per 100,000. It shows that for every 100,000 pregnant women, about 1549 of them will die in pregnancy while the equivalent figure for the South West Nigeria is only 165. In other words, a woman in NE is about 9 times more likely to die in pregnancy than a woman from South West Nigeria.

At the global level, even though there is evidence that life expectancy is converging across countries there are still huge gaps in health across countries. This is why a Norwegian or a Japanese expects to live 85 years, a German expects to live 82 years, and a Nigeria expects to live 52years! And within Nigeria, depending on the circumstances of your birth, rich or poor, powerful or weak, male or female, urban or rural, north or south, your life expectancy will also vary.

These large differences tell us that life and death have more to do with economics than with biology. They have more to do with the choices we make than destiny. It is more about income and how income is distributed than fate.

This means that the health system is also a key site for contestation of economic resources and existing social power structure and inequalities. It is a site for supressing certain interests and advancing new ones. While healthcare is an old profession, indeed one of the oldest professions, the role of health in economic development has been shifting over time leading to what I have termed in this paper the "shifting paradigms".

**Socioeconomic Determinants of Health**

There are three main theoretical frameworks that attempt to explain how economic and social factors affect health outcomes (Commission on Social Determinants of Health CSDH (2008). The first places emphasis on psychosocial factors. It suggests that perceptions and experiences of personal status, or feelings of relative deprivation and unequal status lead to poor health. This framework explains that income inequality rather than average income gives rise to inequalities in health distribution. Leading this research group in the UK is Richard Wilkinson, who in a series of articles in the 1980 and 1990s, proposed the view that income inequality is the critical determinant of variation in health among developed countries (see, for example Wilkinson 1997, 1995). These papers argue that income or inequalities in wealth distribution has pernicious health effects on society in general as it erodes trust, increases anxiety and illness and encourages excessive consumption. In the US, the views of this group were

advanced by Kaplan et al (1999), Kawachi and Kennedy et al (1996), Lynch et al (1998), and Lynch and Kaplan (1997), among others. The consistent evidence from these studies is that unequal income distribution rather than poor income per se gives rise to inequalities in health outcomes. However, it remains a fact that poor income gives rise to poor health. If average income increases, then health indicators tend to respond in the positive.

The second framework is the ecosocial framework which tries to explain the differences in health in terms of both biological and social factors (Krieger 2005). A large number of studies by sociologists, economists and epidemiologists seek to explain the differential distribution of exposure to health risks and disease in a given population, by relating it to variations in social class, socio-economic position (SEP) or socioeconomic status (SES). It is believed that the analysis of risk factors by SEP provides the clue to the causal links between socio-economic groups and health risks (Marmot et al 1987; Liberator et al. 1988). The way in which social actors live, work, and act in general under different circumstances and environments act as mediating pathways for health distribution (Krieger et al. 1997). For this reason, it is important to incorporate social data into the analysis of health. Researchers have also accumulated a mass of evidence that implicate social patterns and stratifications and growing income inequality (CSDH 2008).

Like the ecosocial framework, the social production of disease or the political economy framework argues that factors such as education, gender, power relations, and conditions of work determine our health (see for example, Humphries and van Doorslaer (2000) and Kaplan et al (1996). It is the social context that creates social stratification and assign individuals to different social positions. These social stratifications in turn create differential exposure to health conditions and differential

vulnerability. It also determines the differential consequences of ill-health. According to the Commission on Social Determinants of Health (2007), economic processes and political decisions condition the private resources available and shape the nature of infrastructure, including education, health services , environment, food, and housing quality that shape the individuals of level exposure health to risks and the ability to response to health needs.

### *Medical vs Economic Approaches to Social Determinants of Health*

An important aspect of development economics is the investigation of the economic, social, cultural, political, and institutional factors that constrain the freedom of the individual to be healthy and economically productive. This is what Sachs (2005) refers to as *clinical economics.* Sen (2001) describes this process as "Development as Freedom". Overtime, however, the dominance of researchers from industrialized countries, and more importantly from medical background, have exerted far reaching influences on the development of the social determinants of health.

The literature on the topic has been scarce on low and middle income countries (LMIC), especially Africa. For instance, of the 155 journal papers published in peer reviewed journals reviewed by Wilkinson and Picket (2006) on the association between income and health, about 90% of them focused on Europe and America or other Organization for Economic Cooperation and Development (OECD) countries and virtually none from Africa. This dominance of the literature by researchers from western industrialized countries also means that a large amount of spaces have been given in many health economic journals to issues of western interest such as obesity, drug abuse, plastic surgery, mental health, and diseases of life style. Although these diseases are now growing in importance in Africa (Onwasigwe 2010) as a result of change of diet and other behavioral patterns (Kadiri 2005,

Turshen 1977), the key causes or morbidity and mortality in many Sub-Saharan African countries remain communicable diseases, maternal, neonatal, nutritional disorders, lower respiratory infections, tuberculosis, diarrhoeal diseases, malaria, and maternal causes, HIV/AIDS, among others. These are diseases of poverty and environment and are related to social structure, household and social power relations.

Western researchers have tended to adopt medical models of analysis – the maximization of medical outcomes for the individual patient. This approach is consistent with the prevalence of non-communicable diseases, universal access to healthcare and other social services, robust social and economic infrastructure, health insurance, high incomes, and above all, personal freedom of the individual in societies. These lessen the urgency for researchers from these regions to investigate the economic, social, political and cultural constraints on the individual in the use of healthcare services. Under these conditions, differences in health among individuals or health inequalities resulted more from individual biological constitution, age, and other personal behavioral factors. The structural organization of health services became merely instrumental to achieving individual health outcomes (Ichoku et al 2013).

On the contrary, in many developing countries in Africa and Asia, the individual faces a mountain of economic, political and cultural challenges that limit his/her ability to have optimal access to health services. In many LMIC, personal purchasing power is often low and poverty is endemic; income inequalities is huge, public infrastructure including transportation, information, roads are poor, markets are imperfect leading to information asymmetry; the disease burden is heavy; political and anti-medical cultural belief systems are often pervasive; personal freedom is highly abridged, and the individual is completely embedded in society. These

differences between high income and LMIC countries dictate different approaches to analyzing the determinants of health.

This broader understanding helps to appreciate that etiology of disease and ill-health is not just about the individual biological make up but more importantly involves the whole gamut of social, economic and cultural structure society and how these insert and embed individuals in society. It is the embedding of individuals in a particular society that influences and determines in a very significant sense the kind of health risks they are exposed and their power to make healthcare decisions and to seek necessary remedies.

This model is what I have reflected in Figure 3.

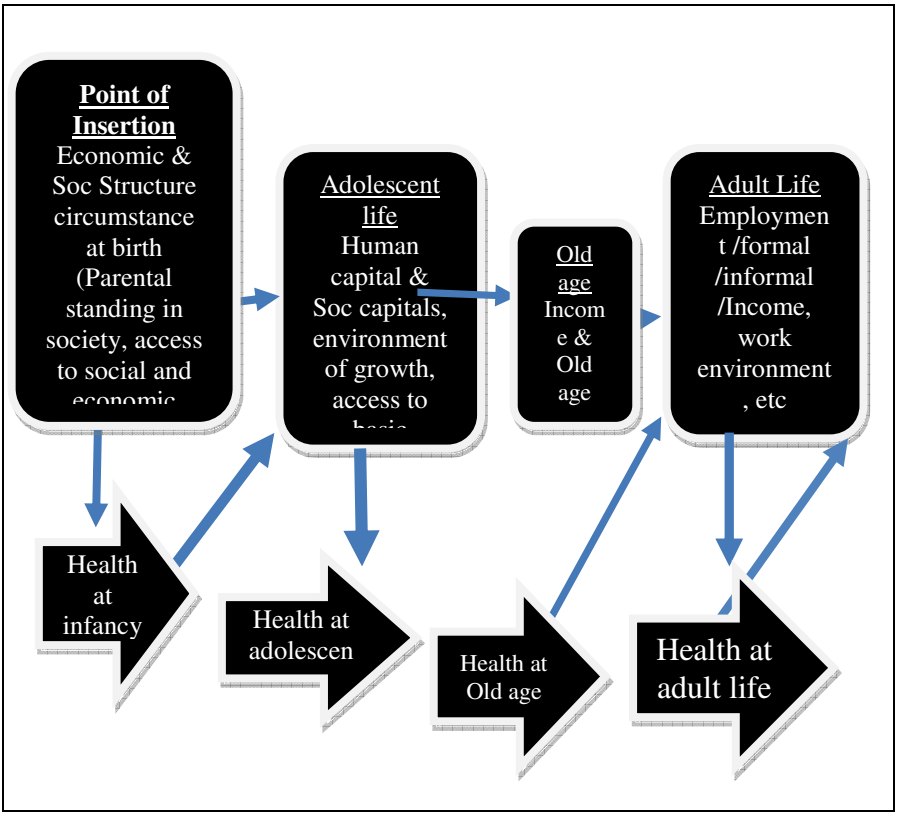


Fig 3: Economic Model of the Social Determinants of Health

The urgency for the study of the social determinants of health in Africa has also been accentuated by the economic and social reform policies in African countries that followed the economic crises of the 1980s and beyond. Neo-liberal economic and social reforms in these countries have tended to widen the gaps in economic and social opportunities between groups in the population (Barro 2000; Bayes 2001; Diene 2004; Aka 2006). A

major platform of the World Bank induced reforms in Africa in the 1990s was the health sector reforms. This introduced cost recovery policies, user fees, decentralization, privatization, commercialization, outsourcing, concessioning and leasing in health institutions. These policies not only reinforced the existing social and economic inequalities but indeed widened them (Mackintosh 2001).

In Nigeria, the economic and social reforms of successive government regimes including liberalization, privatisation and deregulation of economic and social sectors have cumulatively exacerbated inequality in distribution of resources and opportunities in Nigeria (Canagarjan et al. 1997, Okogie et al. 2000; Soludo 2001, Awoyemia and Adeoti. 2004; Alaba et al. 2005*).* In a health system that operates largely on the basis of market forces and on household's ability to pay for health treatment, inequalities in access to economic resources result in unequal access to health services (Alubo, 1987, 2001, Ityavyar 1988) and inequalities in health based on social standing.

Over the years, my research perspective with those of my research collaborators has been to identify, analyze and Africanize the social determinants of health. While researchers from the western world have concentrated their energy on *economics of healthcare* which focuses attention on individual health outcomes, our efforts has been to present an African perspective that sees healthcare as a social institution and health as an outcome of social embedding process. My modest effort has been to challenge the dominant medical model of health economics in order to make health economics address the critical needs of Africa and other developing countries. That is to Africanize the social determinants

of health by identifying and analyzing those economic, social, cultural, political and geographical factors that generate large inequalities in health and mortality in Africa and low economic productivity. We advocate not only for return to the economic model of health economics but also to see health from the social determinant perspective.

My major contributions to better and broader understanding of the socioeconomic determinants of health are contained in Ichoku et al (2013), Ichoku (2011), Ichoku et al (2012) and Ichoku (2013) and will be summarized in the last part of this paper. They comprise both theoretical and methodological contributions.

In summary, while there are differences of emphasis in our approach and that of most researchers in high income countries, the central point remains the same, namely that income, and social and cultural factors determine our health. Pritchett and Summers (1996) summarized these findings in an often quoted title "Wealthier is Healthier". Health outcomes show strong association with income, wealth or the socioeconomic gradient. The causal direction is that improvements in economic conditions lead to improvements in health. Researchers acknowledge that there are differences in health among individuals that have their origins in biological constitution. While pure health inequalities (the biological differences between persons) are not amenable to policy, the health inequalities arising from differences in conditions of living are and these can be addressed by policy. Hence the challenge of equity in health and health financing has become the central goals of most national health systems.

**Part II**

**Reverse Causality: The Healthier is the Wealthier**

**Health as Determinant of Economic Growth.**

Based on the analysis of the socioeconomic determinants of health, development economic researchers believed that there was a unidirectional relationship between health and economic development or growth. The assumption is that this causal relationship runs from wealth to health. As the economy grows and develops leading to improved standard of living, the health of the population also improves. A rising wave lifts all boats. Health is a passive variable in this relationship, or so it was thought. However, there is now accumulation of evidence that good health leads to economic growth (Sachs et al 2001). Improvements in health are essential for economic growth!

Is it not possible that poor health leads to low education, low income and low employment status, low social status, and in general, low economic development equilibrium? While the new scientific evidence of bi-directional causality does not invalidate earlier evidence that health follows the income gradient, it has shifted the conventional paradigm and opened up a new vista in the debate about the relationship between health and economic growth.

Two important recent studies by Becker et al (2005) and Deaton (2004) contributed to bringing about a rethink by researchers on the relationship between health and income growth. These studies found that while health expectancy across countries is converging, income inequality among nations was widening. This evidence of convergence in life expectancy across countries was noted in the

World Bank's *World Development Report of 1993: Investing in Health.*

This intriguing finding that life expectancy across countries was converging while income per capita across countries was widening necessitated a revisit of economic growth theories to see the possibility that health is an input in the economic production function.

***Abridged Review of Existing Economic Growth Models***

While economic growth theory has roots stretching down to Adam Smith and Ricardo in the 18th and 19th centuries, the neoclassical economic growth theory developed in the mid20th century. The Solow-Swan model was developed independently by Robert Solow (1956) and Trevor Swan (1956) and has become the workhorse model of neoclassical economic growth theory. It builds on the neo-classical production framework. The Solow-Swan model unlike its post-Keynesian Harrod-Domar model does not make assumption of fixed capital-output ratio (K/Y) and fixed capital-labor ratio.

The Solow-Swan model assumes that the rate of increase in labour or population growth and the rate of technological progress are exogenous. Using the Cobb-Douglas production function a simple neoclassical growth model may be specified as:

$$Y = Af(K, L) \quad - \quad - \quad - \quad (1)$$

where Y is real output of the economy, K is the capital stock, and L is labor input. $A$ is the measure of technical progress. It is a measure of the level of efficiency in which the economy combines

labour and capital to produce output. This is often referred to as total factor productivity (TFP). Under the neoclassical model this technical progress is assumed to be exogenous, implying that technical knowledge is in the public domain and therefore the same in every economy. In other words, each country shares the same level of technical know-how.

The production function represented by (1) is characterized by:

(a) Constant returns to scale ie $F(\lambda K, \lambda L) = \lambda Y$, implying that raising the inputs by a scalar $\lambda$ raises the output by the same scalar.

(b) Diminishing marginal returns to capital and labor:

$$\frac{\partial F}{\partial K} > 0; \frac{\partial^2 F}{\partial^2 K} < 0 \quad \frac{\partial F}{\partial L} > 0 \quad \frac{\partial^2 F}{\partial^2 L} < 0 \text{ - } \quad \text{ - } \quad (2)$$

By virtue of equation (2), if $\frac{K}{L} \to \infty$ then the marginal product of capital $MPK \to 0$. Similarly as $\frac{K}{L} \to 0$; then $MPK \to \infty$

That is to say, capital is subject to the law of diminishing marginal returns in a closed economy.

**Two Weaknesses of the Solow-Swan Model**

There are two major difficulties that have been identified with the Solow-Swan growth theory. The first is that its prediction of income convergence between poor and rich countries seems to be counterfactual with empirical evidence that suggests divergence (Howit 2005). The postulation of inter-country income convergence is a consequence of the model's assumption of

diminishing marginal productivity of capital implying that output per capita in both rich and poor countries will converge at steady state[3]. Lucas (1988) observes that if the postulation of the Solow-Swan model is true, then capital would move from capital-rich countries to capital-poor countries, a fact that is not supported by empirical data.

The second major difficulty with the model is the assumption of exogenous technological progress or total factor productivity captured in the model as the Solow residual *A*. A large amount of literature suggest that in the Solow-Swan growth accounting model, the factor inputs, labour and capital explain only a limited proportion of the growth of the economy while the unknown parameter TFP accounts for the larger proportion of growth of the economy (Snowdon and Vane 2005, Maddison 1987, Bosworth and Collins 2003, Helpman 1992). In other words, if you pay capital its marginal product (rent) and pay labour its marginal product (wage), more than half of the output will still be left undistributed. For example, Solow (1956) estimated the average growth rate of the America economy for the period 1909-1949 to be 2.9% per year. The labor coefficient or the contribution of labour to this growth was estimated to be 1.09% while the capital coefficient was 0.32%, implying that technological progress made a yearly contribution of 1.49% (=2.9%-0.32%-1.09%). In other words, the unknown residual *A,* explains about 50% of the growth rate of US economy during this period. Similar estimates for the Solow residual have been obtained for South Korea (1.7%) and

[3]As noted above, Deaton (2004) and Becker et al (2005) demonstrate that income per capita across countries has over time diverged rather than converged.

Taiwan (2.6%) and Hong Kong (1.7%) (See for example, Young 1995)

**First Generation Endogenous Growth Model: The Importance of Human Capital**

The first generation of endogenous growth theorists of late 1980's and 1990's, taking a cue from the human capital theory[4] of Becker (1964, 1967), Ben-Porath (1967) and Mincer (1974) and the need to account for non-convergence of income among rich and poor nations, modified the neo-classical economic accounting framework to include human capital defined in terms of knowledge and skill. The early versions of the new growth insights based on theories of human capital and non-diminishing returns to capital were articulated in the works of Romer (1986, 1990), Lucas (1988) and Rebello (1991).

The simplest specification of the endogenous growth model takes the form:

$$y = f(k) = Ak \qquad (3)$$

[4]Human capital theory suggests that a person's stock of knowledge or human capital increases her productivity in the market sector of the economy. This increases her ability to produce income-earning activities. In the non-market or the household sector increase in human capital helps the individual to produce non-tradable commodities that enter into her utility function. The potential for increased income earning in the market sector and improved ability to produce non-market utilities provide the incentive for the individual to invest her resources, including time and financial resources to improve her human capita; through schooling, training, and other self-improvement efforts.

This is known as the $AK$ model in which *y* is output per effective worker, and *k is* capital stock per effective worker. Capital is here broadly defined to include human capital as described above. *A* is a scalar measuring the amount of output produced per unit of broad capital. Unlike in equation (2) where the second partial derivative of output with respect to capital is less than zero, ie $\frac{\partial^2 F}{\partial^2 K} < 0$; in the endogenous growth model $\frac{\partial^2 F}{\partial^2 K} = 0$

Thus, an important property of model (3) is that it is not subject to diminishing marginal returns to capital. An extra unit of capital produces an extra unit of output. In the steady state, the marginal product of capital equals average product of capital; implying constant returns to capital irrespective of how much capital there is.

However, the basic weakness of the AK model is that it lumped together the physical capital whose accumulation was central to the neoclassical model and human capital that is accumulated through improved technical knowledge. It could, therefore, not distinguish between technical progress due to increase in physical capital and technical progress due to improved knowledge or human capital. In this aggregation, the effect of human capital was to counteract diminishing marginal effect that characterize physical capital since human knowledge has potential to keep increasing.

**Schumpeterian Endogenous Growth with Club Convergence**

A new generation of endogenous growth theory is based on the Schumpeterian growth theory and differs from the AK model by distinguishing between physical and human capital effect on technological progress. While savings (investment) make physical

capital to grow, innovation makes human capital to grow. Essentially, the Schumpeterian growth model holds that (Aghion et al 2013):

(i) Innovations generate growth

(ii) Innovations result from entrepreneurial investments by private profit-seeking firms that are motivated by the prospects of monopoly rents;

(iii) New innovations replace old technologies in a process of "creative destruction".

According to Howitt (2005) technological progress comes about by innovations made by profit maximizing firms that lead to what is referred to as "creative destruction" as competition and pursuit of profit leads to continuous innovation, such that, an innovation today is soon made obsolete by new ones tomorrow.

Unlike the AK model of endogenous growth which postulates non-convergence in income between rich and poor countries, the Schumpeterian model of growth like the Solow-Swan growth model, admits convergence but on a different basis. According to the key proponents of this theory Howitt and Mayer-Foulkes (2004), Aghion et al (2013), Barro and Sala-i-Martin (2004 chs 6 &7), income convergence is possible among clubs of countries. The first club is the group of countries that are producers of new scientific idea and innovations through R&D. The second is the intermediate club of countries that are technology implementers and grow through technology imitation of the club of technology leaders. The lowest group is the club of technological implementers with lower levels of efficient and technological absorptive capacity. Per capita incomes in countries within each of

these clubs will tend to converge while income per capita for countries in different clubs will tend to diverge in the long run.

**Health, Human Capital and Economic Growth**

It is within the framework of endogenous growth theories that researchers have come to explore the role of health in economic growth. Van Zon and Muysken (2001:170) argued that "... the general acceptance of human capital formation as a source of growth also warrants a closer look at how changes in the health-state of the population may influence growth and hence total welfare".

The most important formalization of health as durable capital good dates back to the seminal work of Grossman (1972). Grossman argues that there is a fundamental difference between health capital and other forms of human capital because "a person's stock of knowledge affects his market and nonmarket productivity, while his stock of health determines the total amount of time he can spend producing money earnings and commodities" (p. 224). In other words the fundamental and most distinguishing characteristic of health as human capital is that it produces the stock of healthy time available for economic and non-economic production. A large stock of health increases the time available for productive economic activities. A person, therefore, demands health both as an argument in the direct utility function (providing some measure of satisfaction) of the individual and as a capital or investment good because it determines the total amount of time available to the economic agent for money earning production and the production of other goods and services.

Wagstaff (1986) shows that given these conditions, the Grossman's model of health human capital is consistent with the fundamental assumptions of neoclassical microeconomics, namely that the demand for health has a down-ward sloping demand curve, a set of convex indifference cures, a budget constraint and a production function that is subject to diminishing marginal returns at the individual level.

**Health and Economic Growth in the Endogenous Growth Models**

While the preceding economic growth models before now lumped together education and health effects in the production function in explaining the impact of human capital on production process, new growth models now distinguish these effects. It is becoming obvious that health plays a crucial role in economic growth, perhaps even more than education. According to Barro (2013).

> "… health status, as measured by life expectancy or analogous aggregate indicators, is an important contributor to subsequent growth. In fact, initial health seems to be a better predictor than initial education of subsequent economic growth" (p.329)

It is therefore not surprising that new models of endogenous growth are now being developed to account for the effect of health on economic growth (see for example, Zon and Muysken 2005, Sala-i-Martin 2005, Barro and Sala-i-Martin 2004 chs 6&7). These models reflect the different channels through which health exerts influence on economic growth. Assuming, for illustrative purposes, that the production function retains the Cobb-Douglas

characteristics, Barro (2013)[5] provides a theoretical functional specification of this relationship in the form:

$$Y = A.K^{\alpha} S^{\beta} H^{\gamma} L^{1-\alpha-\beta-\gamma} \quad - \quad - \quad (4)$$

where:

$Y$ = Total output of the economy

$A$ = Level of technological development

$K$ = Input of physical capital

$S$ = Level of skill representing worker schooling, training and experience

$H$ = Health capital variable (e.g. life expectancy, adult mortality and even child mortality)

$L$ = Labor hours or total labor force

And, where $\alpha > 0; \beta > 0; \quad \gamma > 0$.

It should be noted that for constant returns to scale the parameters $\alpha + \beta + \gamma + (1 - \alpha - \beta - \gamma) = 1$

In other words, equation (4) suggests that an economy's total output is a function of the rate of technological progress, physical capital investment, skill investment, total labor force and the state of health of the labor force.

The implication of this specification of the endogenous growth equation is that any of these factors: differential technology, differential physical investment (ie savings), differential levels of education or skill, differential health states and quantity of labor

[5]Howitt (2005) provides a similar endogenous growth model incorporating the health variable as an argument.

supply could create differences in income or output levels across countries.

### *Health and Economic Growth: Some Causal Pathways and Empirical Evidence*

What are the pathways through which health exacts influence on economic growth? The emerging interest on the role of health in economic growth and development has generated views that seem controversial. For example, one school of thought that comprises of eminent economists including Gallup et al (1999); Gallup and Sachs (2000), Sachs (2000), Bloom et al. (2001); Bloom et al (2003); Hamoudi and Sachs (1999) hypothesize that geography is a critical channel through which health enters the growth equation. Hence, geographical distribution of disease is a key pathway through which health impacts on economic performance. They argue, for example, that the tropics represent an inclement disease ecology that blights economic growth and makes the diffusion of agricultural technology difficult. This disease ecology is also argued to be responsible for the delayed demographic transition in the countries of the tropics, particularly in Africa.

The second school of thought championed by a group of Harvard economists, Acemoglu et al. (2012) Acemoglu et al (2001); Acemoglu et al (2002); Rodrick et al. (2002); Easterly and Levine (2002); Dollar and Kraay (2002), acknowledge that health influences economic performance but they argue that this influence is mediated through institutions. This group of economists maintain that disease conditions historically accounted for the nature and viability of economic institutions which in turn determine the rate of economic growth.

Acemoglu (2002) and Rodrick et al (2002) using empirical illustrations argue that the nature of economic institutions established by the European colonizers was a key determinant of the economic performance of these colonies up to now. For example, they demonstrate that endemic malaria in tropical Africa made the European colonizers to establish merely transient institutions for extraction of natural resources that fed industries in their home countries. These fragile exploitative institutions generally collapsed at the exit of the colonial master, and thus making economic progress difficult. On the other hand, in places where climate conditions and disease ecology was clement, such as Canada, US, Australia, South Africa, they set up strong institutions to protect property rights and promote economic growth. These account for the much better performance of these regions than much of sub-Saharan Africa (SSA) that is blighted by heavy disease burden.

Several other channels have been shown as important pathways through which health affects health. Some of these include:

**Demographic Transition:** It is argued that improvements in health and reduced child mortality trigger off demographic transition. Such improvements lead to lower precautionary demand for children and, hence, to increased parental investment in each child (Kalemli-Ozcan 2002). If the economy operated on full employment, this transition sets off a period of economic growth (Bloom and Canning 2003; Bloom et al. 2000). However, if there is absence of a dynamic and resilient labor market to create jobs needed to absorb the baby boomers, acute unemployment and poverty may result.

**Savings:** Research suggests that increases in life expectancy is accompanied by higher rate of savings as people who expect to live long have higher incentive to save towards their retirement (Tsai et al. 2000). This savings behavior increases the amount of investible resources in the economy (Bloom et al. 2003).

**Health and Labour Market Outcomes:** There is growing empirical mass of evidence that show causal pathways through which health status at foetal and infant stages of life transmit effects to labour market outcomes. Many of the studies use physiology and anthropometric indicators to quantify the effects of health status at early stages of life on adult labour market outcomes. A major channel that has been identified runs from stature and chronic diseases to labour market outcomes (Fogel 1994; Stackel 1996; Strauss and Thomas 1998; Backer 1997; Morton 1955; Harding 2001; Stern et al 1996; Arora 2001; Martyn et al. 1996; Case et al. 2004). These studies show strong evidence that malnutrition at the foetal stage of life is "a central stimulus for programming of susceptibility to adult disease"[6] (Harding 2001:15).

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[6]Medical scientists and nutritionists provide three main sources of evidence for this outcome (Harding 2001):

(a) Animal experiments: It is shown that reducing the fraction of protein in diet for pregnant rats leads to the birth of off-springs with reduced weight and 'elevated blood pressure'

(b) Manipulation of maternal nutrition in humans lead to babies with reduced birth size and 'increased risk of glucose intolerance and obesity in adult life'

(c) Evidence from cross-breeding of embryo and transplant experiments show that size at birth is determined by the uterineenvironment of the baby and the capacity of the mother to supply nutrients to the foetus.

Some empirical evidence (Stern et al 1996; and Barker 1997) has established a strong correlation between small size at birth resulting from poor health and malnutrition at early stages of life and adult coronary heart diseases including diabetes. These associations are irreversible even with adult life modifications. That is to say, the effects of poor health and malnutrition at infancy lead to programming of health and consequently poor labor market outcomes at adult stage of life. Further evidence suggests that adaptations made by the foetus in the environment of starvation and malnutrition lead to enduring changes in the metabolism and organ structure, including adult stature. This programming is invariant to adult life behavior modifications.

Similar results to the foregoing were obtained by Johnson and Shoeni (2011). Using national data from the US, Johnson and Shoeni (2011) find that low birth weight ages people in their 30s and 40s by 12 years, increases the probability of dropping out of school by about 33%, lowers labor force participation by 5% and reduces human capital accumulation, reducing labor market income by 15% and reinforces intergenerational transmission of poverty within the family. Another empirical result published the same year, Neelsen and Stratmann (2011) that studied the long-run effect of early-life exposure to the Greek 1941-1942 famine find severe adverse educational outcomes for the cohort of infants conceived or born during that period. These findings are consistent with results from earlier empirical econometric analysis by Steckel who after controlling for compounding and feedbacks, show that, on average, height is a good predictor of adult earning. This result is supported by several other empirical results including

Deolikar (1988) Basta et al (1979), Sahn and Alderman (1988), and Bleakley (2007).

Furthermore, quasi-experimental studies using observational data have played a significant role in providing insight into the effect of health on productivity and earnings. A number of studies have estimated the relationship between stature and earnings using micro data. In estimating the effect of stature on earnings, Schultz (2002, 2005) found that a one centimetre increase in height was associated with 6-8% increase in wages in Ghana and Ivory Coast while a one unit increase in female biomass index (BMI) led to a 15% (7%) increase in wages in Ivory Coast and Ghana. Similar evidence also exists among Ethiopian farmers, where a 1% increase in BMI is associated with 2.7% increase in earnings (Croppenstedt and Muller, 2000). BMI has also been found to positively determine wages in urban Brazil (Strauss, 1986). Though the foregoing suggests that BMI, along with height, exerts a positive impact on earnings in developing countries (perhaps through increased body capabilities), it is important to highlight the fact that BMI values that are at least 25 have been categorized as unhealthy by the WHO (Ardington and Case, 2009). Therefore, it is not surprising that high BMI (indicating overweight/obesity) is often associated with lower income in advanced economies (see e.g. Wittenberg, 2011).

Findings from Steckel (1995) using human stature[7] as health variable clearly indicate a high level of correlation between a

[7] Human stature is considered a very important health indicator because it not only shows accumulated effects of health inputs in an individual but also the demand that is made on the outcomes of those inputs. In other words, it is a net

country's population average height and per capita income. This correlation is estimated to be in the range of 0.82 to 0.88, and the elasticity of height to log of per capita income is about 0.27 for adolescents and 0.19 for adults.

Seminal studies by two eminent economists, Robert Fogel, a Nobel Prize Winner in Economics 1993 and Suchit Arora of the University of Ohio using historical data have helped to shed important light on the relationship between health and economic growth. Fogel's 1994 Nobel Prize Lecture using data on health indicator spanning the period 1790-1980 shows that improvements in nutrition accounted for 30% of the growth of British economy over the period. In a study comparable to Fogel (1994) but using data on additional four health indicators covering 125 years for ten developed countries[8] Arora (2001) shows that improvements in life expectancy accounted for 30-40% of the economic growth in these countries within the period covered by the study. The importance of these two studies is: they show that improvements in health make significant contributions to health and these contributions are robust to changes over time.

In drawing a link between nutrition (and health) and economic prosperity, Thomas and Frankenberg (2002: 106-107) argue that:

> The link between nutrition and productivity arguably provides the best documented evidence on interrelationships between health and economic prosperity. The evidence

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effect of input into the health production function and the demand that is made on the output.

[8] These countries include Australia, Denmark, Finland, France, Italy, Japan, Netherlands, Norway, Sweden and Britain.

> suggests that, along with genotype and environmental influences, diet plays a role in the etiology of many chronic diseases.

Case et al (2004) identify poor child health as, perhaps, the most important channel through which intergenerational poverty and other disadvantages are transmitted. Children born into very poor homes are likely to experience poor childhood health, poor investment in human capital, and consequently, poor health and low income at their prime when they also become parents.

Other studies from microeconomic perspective using panel data and labor market survey find equally strong evidence that health is a major argument in economic performance. For example Lorentzen et al (2008) and Bhargava et al (2001) using cross-national and sub-national data of 98 countries and controlling for the age pattern of mortality and endogeneity problems, found that the effect of high adult mortality rate on economic growth in Africa is so large that it accounts for the region's growth stagnation relative to other regions of the world. More specifically, they estimate that SSA grew 1.65% less than the rest of the world from 1960-2000 on account of high mortality rates in the region. This loss in economic growth implies that over the 40-year period the per capita income gap between sub-Saharan Africa and the rest of the world doubled.

**Summary and Policy Implications**

Current research evidence suggests that health and economic development have two-way relationship. The first part of this paper shows that economic growth and development affect health through the social determinants of health. Economic growth and

development help to overcome the major economic and social constraints including conditions of economic hardship, physical environment, health damaging behavior and exposures to experiences that tend to make life short. They tend to improve people's economic and material wellbeing, knowledge, power and prestige, social connections such that people are better equipped to avoid damaging health risks. Improved economic and material wellbeing empower people with better protective strategies that help to reduce the burden of disease, avoid premature death, and live longer.

The foregoing implies that morbidity and mortality have also social and economic etiology. This means that the whole gamut of social, economic, political, environmental, cultural, and even religious structure of a society which determine the power distribution in society and how individuals are embedded or inserted into society are implicated in disease etiology. These generate health inequalities and determine also the answer to the question: "Who shall live?" Therefore, economic development is about addressing the question of how individuals are inserted into the social structure which determine how the resources of society are generated and distributed. This provides a broader framework to the traditional biological/medical framework that emphasizes only the biological etiology of disease and ill-health.

This socioeconomic determinants approach to health distribution has implication for the nature and structure of healthcare in society. It implies that improvements in the general health of the population must also be addressed through economic and social policies reforms that address the material conditions and environment under which we live and work. This also justifies the inter- and multi-sectoral approach to improving population health. The traditional narrow understanding of health and healthcare as the exclusive province of the medical profession and institutions

should yield way to a broader conceptualization of health as an arena for many different stakeholders including medical and non-medical actors. This is a major paradigm shift.

The second paradigm shift is the health-income relationship. Based on the hypothesized unidirectional relationship that runs from economic growth to health, economists first tried to determine the socioeconomic variables that accounted for the income-health gradient. Income, education and occupation were the key variables. Consensus was then built to the effect that improvements in income or economic growth is a necessary condition for improvement in health. However, evidence emerged to show that this relationship is bidirectional rather than unidirectional. The growth models formed the framework for a new generation of research to decide the validity or otherwise of the claims.

The neoclassical growth theory discountenanced the quality of human being in the growth process. The emphasis was exclusively on the role of capital accumulation in the growth process while human capital received no attention. Health and education were excluded from the arguments in the growth equation. The model postulated income convergence based on diminishing marginal returns to capital. Yet the core of the growth equation, which is technological progress remained exogenous, a kind of manna from heaven. The first generation of endogenous growth models tried to endogenize technical progress by introducing the role of human capital into the growth equation and recognizing the role of the quality of the labor force in the production process. However, it failed to distinguish the contribution of human capital and increases in the physical capital in explaining technical progress.

The result was a growth model that was able to only explain the observed non-convergence across countries in the steady state.

The new generation of endogenous growth models largely based on the Schumpeterian growth theory of "creative destruction" and imperfect market distinguished between the role pure increases in physical capital and increases in human capital in achieving technical progress. This model showed the possibility of income convergence and non-income convergence across countries. Income convergence is possible within clubs of countries while non-convergence remains the norm across countries at different levels of technological development. The main achievement of endogenous growth models is the recognition of the quality of human beings including education and health as key drivers of economic growth.

This recognition that health plays a key role in the growth process led to further investigation regarding the pathways through which the mutual effects of health and income were accomplished. This was a difficult task given the simultaneous nature of the effect, the econometric problem of identification, and the need for instrumental variables for econometric estimation of the empirical models. However, a number of channels have been identified through which health influences economic growth. These include but not limited to productivity efficiency, institutions, the labor market, demography etc. These channels and more show the various ways that health determine economic growth.

Empirical findings show that the magnitude of impact of health on economic growth is large. In many cases, studies show that health contributes between 30- 40% of GDP growth. Using historical data

some researchers show that this contribution is robust to changes over time. Furthermore, anthropometrical studies show evidence that health at the infant and early stages of life is critical for latter health and productivity of individuals at adult stage. In fact some studies show that our health at adult stages is programmed during our formative years.

These findings have several implications.

- There is need for a shift of emphasis from narrow biological origins of ill-health and diseases to wider social and economic conditions of living. This is, in essence, the social determinants of health that emphasize the influence of the structure of, power distribution in the household and in society at large, and how different individuals are inserted in it which determine the answer to the question "who shall live?"

- The endogenous growth model's demonstration that health is an important argument in the growth equation has far reaching implications for income distribution. Capital has been shown to be the major source of growing across-country and within country inequality in the world today (Picketty 2014). On the other hand labor income earnings, while large, is more evenly distributed within countries. Therefore, the huge income inequalities that characterize our country today can only be reduced through more investment in education and health of the population.

- Labor is the most important asset of the poor. Ill health devalues this asset and plunges poor households deeper into poverty particularly if the breadwinner of the

household becomes ill. Investment in health of the population, particularly of the poor is one of the surest ways of reducing poverty.

- It is so often the case that the Ministry of Finance in budget allocations consider the Ministry of Health as a mere consumption ministry because it is assumed not to contribute to economic growth. In times of economic recession the MOH is one of the first victims of budget cut. This presentation has shown that health is not only a consumption good, which is enjoyed only by the individual for the release from pain and mortality, but that it is also a critical input into the production function. Indeed it is health that determines the amount of time available to the individual for productive work and the intensity of work.

- The finding that the health at infancy determines or programs our health and productivity as adults has also far reaching implications for economic policy. It implies that health is a major channel through which intergenerational poverty is transmitted. Unfortunately, today, poor child health, malnutrition, stunting, and wasting, have spread like epidemics in large of parts of Nigeria. Data from Nigeria Demographic and Health Surveys 2008 and 2013 show that in many states of Nigeria today, the incidence of child malnutrition is as much 45% percent. The implication is that the future of these malnourished generations of children is already compromised and endangered and should they survive there, is high risk that their economic contributions to the economy will be sub-optimal.

In general, the two-way interplay between health and economic growth creates a new perspective for viewing health and health institutions as social and economic institutions and exciting new possibility for using investment in health to stimulate national and international development. It does not mean that health is the only important variable in economic development but it provides evidence that health is central to economic development and should be accorded priority in national and sub-national development plans.

## Part III

### *Contributions to Literature*

An economist may contribute to advancement of knowledge by:

- Advancing new theoretical and conceptual insights into a subject matter
- Developing a new methodology or improving on existing one in the study of an economic phenomenon.
- empirical verification of existing theories or methodologies

My major contributions to literature have ranged from theoretical to empirical contributions. I summarize here some of the specific contributions.

Contributions to Theoretical Literature**:** My major contributions to theoretical literature are contained in three journal papers and a book chapter: Ichoku et al (2013), Ichoku (2010), Ichoku et al (2012) and Ichoku (2013). These papers argue for the shift of paradigm in the theoretical approach to health economics. To the best of my knowledge, Ichoku et al (2013) was the first paper to argue for the Africanization of the social determinants of health that shifts emphasizes from the dominant western medical paradigm to health analysis that emphasizes individual health outcomes to a an approach that takes into consideration the economic and social conditions of living in Africa and other developing countries.

These papers argue for more inclusive approach to understanding health and healthcare in Sub-Saharan Africa (SSA). The peculiar economic and social structure of SSA societies characterized by poverty, deprivation, inequality, prevalence of pre-medical beliefs, skewed household and social power distribution, that are critical to social embedding of individuals, and their access to health

services, dictate a different approach to understanding the social determinants of health.

My central thesis is that the way society is structured, the mode of economic production, the social network, the distribution of power within the household and society at large, the norms and institutions that govern social interaction and power networks, and the values and culture of the society determine where and how individuals are inserted into their society (the circumstances of birth). How individuals are embedded or inserted into the social and economic structure in turn influence the childhood experience and health which in turn shapes the adult health as shown in Figure 1. Whether a child was born into a rich or poor home, urban or rural area, born male or female, has food or no food, has access to electricity or not, will affect the initial health stock of the child. This in turn will determine his or her ability to learn and build a stock of human capital as an adolescent.

The level of human and social capital he/she builds at the adolescence stage will determine his/her future access to social services, health services and in fact this ability to produce health from available economic, human, and social capital around him or her. This in turn will affect his/her life at adult age. This is without prejudice to the stock of natural health (biological endowments) and his/her innate abilities to recreate his/her circumstance. These make it clear that health institutions are social institutions. These social determinants of health are the legitimate concerns of the discipline of health economics, from an African perspective. Not the economics of healthcare that focuses on health outcomes of individual medical procedures.

In other words, while the proximate answer to the question: "Who shall live?" is decided by healthcare services, the remote decision has largely been determined by the overall circumstances of one's insertion into the society.

My other theoretical contribution to the development of the study of health and economic development has been in the study of the social determinants of health from the historical perspective. When literature is not completely western in the consideration of social determinants of health it is narrowly focused on the proximate determinants of health. For example, researchers have concentrated effort on such proximate determinants of health as income, environment, education, etc. However, we argued that so much effort has focused on these proximate determinants to the utter neglect of historical determinants of health (Ichoku et al, 2013). Our perspective is that history, particularly, colonial history, in the case of Africa and other developing countries, played a large role in determining the current distribution of access not only to health services but also to other social services and the formation of human capital. For example, in Ghana, investment in health followed the historical patterns of colonial settlement. Statistics show that as at 1998, only 6% of doctors in Ghana worked in northern region of the country with a population of 4 million people whereas Greater Accra Region with 12.5% of the population employed half of the country's doctors (see Devlo 1998). About 87% of the country's physicians work in urban areas even though 66% of the population live in rural area. This pattern of development emerged historically as the colonial centers of settlement became the points of concentration of social services.

Similar patterns are observed in Nigeria. As I was preparing a Medium Term Expenditure Framework (MTEF) for Yobe State in 2012, I computed from the data supplied by the state, that in some Local Government Areas of the state, the doctor to population ratio was 1:123,000 whereas in many southern cities in Nigeria the ratio was about 1:2000. This pattern of development in medical services in Nigeria, like in Ghana, followed the same colonial pattern. In the case of Nigeria, the missionaries from Ireland brought education and medical services followed the paths of the colonial government officials. And since the south had more concentration of missionary activities, the south also had a head start in education and health services (see for example Itavyer 1987). So theoretically speaking, social determinants of health have historical roots and must be considered a major factor in accounting for the present inequalities in health in developing countries.

This leads to my hypothesis that history is also important for accounting for the large inequalities in the present distribution of social services and access. However, it seems that too often analysis of these issues ignore history and take no account of the post-colonial influences that still have influences on distribution of health and health services today.

**My Contributions to Methodology of Economics:** My work and contributions here focus on the measurement of socioeconomic status in Africa. Socioeconomic status (SES) is an important variable for the estimation of the magnitude of social gradients in the distribution of health in a society and estimation of poverty.

However, the dominant literature in the measurement of SES based on European experience has been the British Registrar General's Occupational Scale that was developed in 1911 and which in turn is derived from the Weberian perspective of defining social relations. International development agencies, and researchers working in Africa frequently rely on the construction of a Wealth or Asset Index from households' reported list of durable assets using the Principal Component Analysis (PCA) or Factor Analysis. The scores are used to rank households to obtain their SES. This in turn is used to construct a Concentration Index of Inequality. Studies have, however, shown that the Asset Index often constructed using the PCA or factor analysis, or even multiple correspondence analyses (MCA), is poorly correlated with household consumption (Laura et al 2008, Montgomery et al 2007) which is often regarded as better approximation of permanent income (and therefore a better measure of SES).

In Ichoku (2010) and Ichoku (2013) I argue that the use of Wealth Index for estimating poverty and inequalities in health is inappropriate for studies in Africa. The epistemological pre-supposition behind the adoption of wealth index as a measure of socioeconomic status in Africa is the empiricist epistemology which is anchored on inter-subjective observability. For George Berkely (1685-1753), one of the greatest proponents of empiricism, *esse est percipi* (to be is to be perceived). Phenomena that are not inter-subjectively observable do not exist! The essence is to make phenomena inter-subjectively comparable. In this sense history and other cultures can only be understood by benchmarking and comparing them with western standards. By reducing things to a common standard, monetary income or wealth score, for example, the relative welfare of people of other cultures

and economic systems can be compared with those of the Europeans. This is without recourse to the completely different value system that underlie the different cultures and economic systems.

My thesis is that, unlike the industrialized countries of Europe and America where the economy is completely monetized, SSA operates dual economy: the subsistent economy that is non-monetized and the urban economy that is monetized. Values of households' asset holdings in these two sectors of the economy are different and non-comparable. For example, using the wealth index, a young graduate who works in the bank, rents a flat in the city and has a modest bank account but has no landed property neither in the city nor in the village could be considered richer than a man in the village who owns no bank account but has vast lands, and herds of cattle, and is titled and respected in the village! I demonstrated that the use of wealth assets in dual economies like Africa will lead to contradictory socioeconomic rankings of households.

In Ichoku (2010, 2013) I further argue that this empiricist epistemological approach to the study of phenomena in Africa is complicated by households' choice of portfolio of investment. A household that is risk averse, and this is typical in Africa, would normally spread its risks between the two economies. Thus, a school teacher may also be a subsistent farmer. How then does the researcher assign ranks to wealth distributed between two economies?

My perspective, therefore, is for the adoption of the phonological approach to the measurement of SES. This assumes that social

phenomena depend for their existence and significance on the meaning ascribed to them by the members of the society. Therefore, social hierarchies or social status could be measured without recourse to comparable Wealth Index or income. Members of communities know the appropriate ordering of individuals with their societies. They know who is poor, and who is not. This is sufficient for establishing social hierarchies for the purposes of social intervention.

Treatment Prost Zeros in Health Contingent Valuation Studies
Quite often, in survey methods researchers face the challenge of how to deal with protest zero (as opposed to true zeros from respondents). The existing econometrics for handing these protest zeros was analyzed in Fonta, Ichoku and Kabubo-Maria (2010) which suggested alternative econometric approach that combines the Ordinary Least Squares, Heckman's 2-Step and Full Information Maximum Likelihood estimation techniques.

**Contributions to Knowledge through Empirical Research**
A large number of my published work are empirical research findings which I co-authored with a number of colleagues, including Dr William Fonta, Professor Obinna Onwujekwe, Dr John Ataguba, Professor Murray Libbrandt, Professor Michael Thiede, Charles Ezenduka, Noah Alilu, one of my PhD students, among others. These papers basically try to demonstrate or validated existing theories or methods proposed by other researchers. These have been used to provide evidence for policy making purposes by public decision makers. These contributions can be categorized into:

- Health Financing: these include publications that basically seek to ascertain the impact of the prevailing out-of-pocket health expenditures in Nigeria and the income

distributional effects. They try to demonstrate the extent of prevalence of catastrophic health financing in Nigeria and to estimate the level of impoverishing effect arising from households paying for health out-of-pocket in the absence of pooling mechanisms. They also try to estimate the willingness of Nigerians to pay for health through health insurance or community health insurance.

- Technical efficiency of health institutions: A number of our published papers (Ichoku et al 2011, Alilu and Ichoku 2015, Kirigia et al Kirigia et al 2011 etc) try to estimate the level of technical efficiency and the level of effective resource use in our health institution for policy purposes. One of the studies for example shows that the hospitals in the South East are less than 60% efficient.

- Equity studies: The majority of my empirical studies fall under the category. The papers try to estimate the level of inequities in health among the Nigerian populations and the level of inequities in health financing. This set of studies include Ichoku and Nwosu (2011) and Onwujekwe et al (2009).

A number of other empirical studies cover a wide range of issues including environment, political economy of health financing among others that cannot be discussed in details here. Many have resulted from my field work for many international development agencies including the World Bank, DFID, USAID, WHO, among others.

**Future Research Horizons**

My last fifteen years of economic research has largely focused on examining the relationship between health and economic development, and factors that generate unequal health distribution and access in society. A major limiting factor in applying the full

apparatus of econometrics to estimating and quantifying the relationship between health and economic growth is the absence of appropriate data in Africa and in Nigeria in particular. However, with increasing scope of data generated by the National Bureau of Statistics, undertaking appropriate econometric estimation of this relationship seems now feasible. One area of my future research effort will, therefore, focus more closely on using quantitative methods to establish the relationship between health and labor market outcomes in Nigeria. I hope to investigate, in addition, the role of health human capital in income distribution. This will involve the use of different simultaneous equation models, including the Instrumental Variables, Limited Information and Full Information Maximum Likelihood estimation techniques to explore the feedback effects between health and labor market outcomes.

In our final year Macroeconomic Theory and Policy II course, Professor Soludo taught us that "Political expediency will always override economic rationality" This is meant to underscore the fact that no matter how elegant an economic analysis is, no matter how rational and convincing, the politician will always choose that economic alternative that is more politically expedient. Without the constraints imposed by academic promotion, one can now enjoy the luxury of free academic enquiry. One areas that I intend to focus my future research is to understand better the use of political power and the role institutions in financing public goods. Including environment and climate change. God keep us alive.

**Appreciation**

The race is not to the swift,
Nor the battle to the strong,
Nor bread to the wise,
Nor riches to the men of understanding,
Nor favour to men of skill;

But time and chance happen to them all. (Eccl 9:11)

My academic journey has been quite eventful and fruitful. I want to thank the Almighty Father who has made our path on this journey peaceful and prosperous.

I remain indebted to all who gave a helping hand on this path. My first thanks goes to Arch Bishop AK Obiefuna (late) who as my Bishop in the Catholic Diocese of Awka supported my aspiration to study Economics after my priestly ordination. I thank his successors, late Bishop A Okafor, and the current Bishop PC Ezeokafor and his Auxiliary, JB Okoye whose encouragement has sustained me. I remained deeply indebted to Msgr. JK Aniagwu of St Leo's Parish Lagos who has been a great father and mentor to me and Professor C Ejizu of University of Port Harcourt who encouraged to begin with first degree in Economics. I thank my long-time friends Rev Fr Dr J. Mgbobukwa, Fr S. Dunu, Rev Fr Professor BAC Obiefuna, and Rev Fr Dr N. Ofojebe for outstanding friendship and support.

A number of people too many to mention have influenced and supported my academic struggle over these two decades, from the time I set foot into UNN in 1993 to begin undergraduate course in economics to the present time. Special thanks to Professor O Ijeoma who was instrumental to my coming to read economics in UNN rather than ESUT. God bless and keep you for your good works. I owe a lot of my academic progress to my great mentor and friend, late Professor Augustine Okore, who never tied of reminding me that he attended church for two things: good homily and good music! ..and, unfortunately, that he could not have opportunity to ask me questions in the church after my homily in the same way I asked him questions in his demography class! May God rest him.

My deep thanks to Professor CC Soludo who as my lecturer was an extra-ordinary inspiration for me. He was also instrumental to my coming back to UNN after my Master's degree at the University of Cape Town. I thank my great mentors in the Department of Economics: Professors A Okorafor, FE Onah, IN Ikpeze, CC Agu, and my current colleagues in the Department of Economics for their support and friendship. Dr Chima provided me the opportunity to compete for the Scholarship of the Swedish International Development Agency (SIDA) to pursue a Master's degree at the University of Cape Town, I'm ever grateful.

I deeply appreciate the research support provided me by Dr. W. Fonta, Professor Obinna Onwujekwe and the Health Policy Research Group (HPRG).

How can I finish without remembering my friends and lecturers at the University of Cape Town who made it possible for me to complete my Masters and PhD in that University in record time and who continue to take me as one of their own? Professor Di MacIntyre, my indefatigable founding director of Health Economics Unit at the University of Cape Town. Professors Murray Libbrandt and Michael Thiede who supervised my Master's and PhD dissertations. Dr Steve Thomas and Edina Sinanovic who as directors of HEU helped me secure full scholarship of SIDA for six of my students in the Dept of Economics UNN to study at the University of Cape Town. My deep appreciation to Dr Michael van Heerden, Peter Ramsdeen, Virigina O'Connor, and Wilson among many others. I can't forget the fatherly love of the late Archbishop Henry of Cape Town who, when it was clear I could not stay back in Cape Town to work, was happy to accept priests from my diocese instead.

I want to thank my biological family for their support all these years. I am aware they have got used to the distance between them and myself on account my vocation and my long years in

academics. My mother and first mentor, Mary Ichoku (Arude) who could not be here in person to witness this event, my brothers, sisters, and cousins and their families, I thanks you for your support.

To all my own people of Nawfia, and friends who have come from Abuja, Lagos, Port Harcourt and different parts of this country to witness this momentous occasion, I deeply appreciate your presence here today.

To the priests and religious on campus, Awka and Nsukka Dioceses my deep appreciation for your support and friendship.

I thanks my past students and friends without whom I cannot be what I'm today. A teacher is only as a great as his products. I thank them in particular for sponsoring this event. They include: Mr Elijah Onyeagba, Dr Emmanuel Adamgbe, Dr Moses Oduh, Ifeanyi Obijiaku, Okey Nnake, Nnamdo Ejimofor, Dr Nath Urama. Many thanks to Dr Romanus Ezebuilo and his team that organized this event. I want to acknowledge before this audience the kindness of Dr Charles Ezema who last year at my priestly silver jubilee gave me one million naira (₦1,000,000.00) only to support indigent students. May God show you kindness.

The UNN academic community has been a source pride and inspiration to me. Without exception, I want to thanks you all for giving me the opportunity to grow among you, and making me a lion. I keep struggling to be what a lion should be, a great academic. Like Jabbez, my prayer is: May God enlarge your coasts.

Thank you all.

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## INAUGURAL LECTURES
## OF THE UNIVERSITY OF NIGERIA, NSUKKA

1. **Prof. K. Nzimiro – 1976**
   **Title:** The Crisis in the Social Sciences: The Nigerian Situation

2. **Prof. Chika Okonjo – 1976**
   **Title:** Economic Science, Imperialism and Nigerian Development.

3. **Prof. K. S. Hegde, Vet. Medicine – 1977**
   **Title:**

4. **Prof. D. I. Nwoga – 1977**
   **Title**: Visions Alternatives: Literary Studies in a Transitional Culture.

5. **Prof. J. A. Umeh – 1977**
   **Title:** Land Policies and Compulsory Acquisition of Private Land for Public Purposes in Nigeria.

6. **Prof. D. C. Nwafo – 1984**
   **Title:** The Surgeon as an Academic

7. **Prof. G. E. K. Ofomata – 1985**
   **Title:** Soil Erosion in Nigeria: The views of a Geomorphologist.

8. **Prof. E. U. Odigboh – 1985**
   **Title:** Mechanization of cassava production and processing: A Decade of Design and Development.

9. **Prof. R. O. Ohuche – 1986**
   **Title:** Discovering what Learners have attained in Mathematics.

10. **Prof. S. C. Ohaegbulam – 1986**
**Title:** Brain Surgery: A Luxury in a Developing Country like Nigeria.

11. **Prof. I. C. Ononogbu – 1998**
**Title:** Lipids: Your Friend or Foe.

12. **Prof. V. E. Harbor-Peters – 2001**
**Title:** Unmasking some Aversive Aspects of Schools Mathematics and Strategies for averting them.

13. **Prof. P. O. Esedebe – 2003**
**Title:** Reflections on History, Nation Building and the University of Nigeria.

14. **Prof. E. P. Nwabueze – 2005**
**Title:** In the Spirit of Thespis: The Theatre Arts and National Integration.

15. **Prof. I. U. Obi – 2006**
**Title:** What have I done as an Agricultural Scientist? (Achievements, Problems and Solution Proposals).

16. **Prof. P. A. Nwachukwu – 2006**
**Title:** A Journey through the Uncharted Terrain of Igbo Linguistics.

17. **Rev. Fr. Prof. A. N. Akwanya – 2007**
**Title:** English Language learning in Nigeria: In Search of an Enabling Principle.

18. **Prof. T. UzodinmaNwala – 2007**
**Title:** The OtontiNduka Mandate: From Tradition to Modernity.

19. **Prof. J. A. Ibemesi – June 2007**
**Title:** From studies in Polymers and Vegetable oils to Sanitization of the Academic System.

20. **Prof. Obi U. Njoku – June 2007**
**Title:** Lipid Biochemistry: Providing New Insights in our Environment.

21. **Prof. Humphrey Assisi Asobie – July 2007**
**Title:** Re-inventing the Study of International Relations: From State and State Power to Man and Social Forces.

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