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SOCIO-ECONOMIC DETERMINANTS OF HEALTH OUTCOMES IN THE SADC REGION

[1]David Damiyano, [2]Nirmala Dorasamy

Abstract

The outcomes of health are influenced by many diverse factors which range from socio-economic to health systems and environmental issues. This study will focus on health outcomes being represented by life expectancy. There are quite a several theoretical models which described the health determinants concerning the outcomes including the Wilber and Grossman models. In this study, the health indicators considered are total health expenditures, antiretroviral coverage, improved water source. The study considers 11 of the 16 SADC countries using panel data for the period 2000-2015 from the World Bank for the study. Health outcomes were proxy buy life expectancy from birth and current health expenditure per capita (US$), Antiretroviral coverage as a percentage of people living with HIV as well as an improved water source as a percentage of the population were considered as independent variables. A unit change in current health expenditure per capita results in 0.099162 positive change in life expectancy at birth. Increase in coverage to those on people living with HIV will result in reduced deaths, increased quality of life and hence raining up the life expectancy. Improved water supply source is statistically significant but is negative which is inconsistent with literature.

Keywords: *socio-economic, health outcome, health expenditures, antiretroviral, water source*

I. INTRODUCTION

Health is a basic right for every human being with the Alma Ata Declaration of 1978 putting that at a global perspective (WHO 1978). There were subsequent targets set at the global level for the provision of efficient and equitable health care and services to the population such as the Sustainable Development Goals SDGs and Universal Health Coverage (UHC) by 2030 among other continental and regional agreements (WHO 2017). Health is a critical component in human productivity, poverty reduction and ultimately economic growth (Nabyonga-Oren 2019). Health is measured by its outcomes such as years of healthy life lived from birth, infant mortality rates and maternal mortality rates among others. The outcomes of health are influenced by many diverse factors which range from socio-economic to health systems and environmental issues. (Ataguba et al 2015, Marmot et al 2003). This study will focus on health

[1] *Senior Lecturer, Bindura University of Science Education, Bindura, Zimbabwe/ Honorary Research Associate, Durban University of Technology, Durban, South Africa*
[2] *Professor, Durban University of Technology, Durban, South Africa.*

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outcomes being represented by life expectancy. Life expectancy being the average number of years that a new-born could be expected to live if he/she were to pass through life subject to the age-specific death rates of a given period. The determinants being economic represented by total government health expenditure, physical- looking at water and sanitation issues and health services-looking at manpower availability and coverage of HIV treatment.

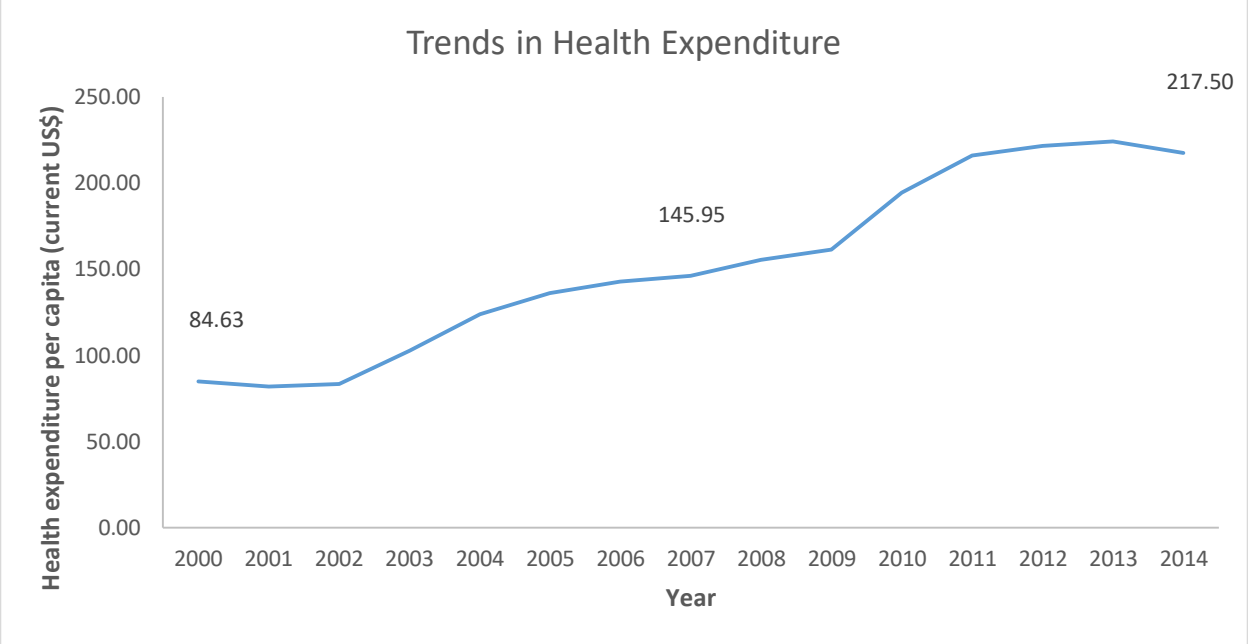
BACKGROUND OF THE STUDY

The world disease burden has been on the increase especially the rise of non-communicable diseases such as cardiovascular disease and cancers which caused about 41 million deaths out of the total of 57 million globally in 2016. This is due to increased ageing population resulting from an increased life expectancy, urbanisation, consumption of unhealthy food as well as increased consumption of alcohol and smoking (WHS2018). Communicable diseases are still a challenge in most parts of the world and outbreaks of multi-resistant pathogens have effectively rendered certain microbial ineffective hence resulting in increased mortality and morbidity. Lack of skilled health professionals because of inadequate supplies or brain drain has compromised the health delivery systems with 76 countries having less than one physician per 1000 people. Essential drug shortages having become perennial and have complicated disease treatment and management. By the end of 2016, only 53% of people living with HIV globally have been receiving antiretroviral drugs (UN 2017). This has resulted in increased mortality rates especially in developing countries which happen to have the bulk of the population as well as high disease burden and less health care expenditure. (Eshatu E. et al 2011)

Governments' allocation of budget to social services has generally been inadequate in most developing countries. This is due to constrained government expenditure due to lower revenue collection as a percentage of GDP. This has resulted in fiscal deficit leading to lower expenditure on the provision of clean water and proper sanitation, investment in education, food security and supporting primary health care. African governments as pledged through the Abuja declaration to provide at least 15% of the total budget towards health by 2015 but less than a quarter have done so (McIntyre et al 2016). Some of the countries are signatories to the Universal health coverage by 2030 and the Sustainable Millennium Development goals (SDGs) which has 9 of its goals covering most of the health determinants (UN 2015).

Global health custodians, WHO and other development partners such as UNICEF, UNDP, World Bank and others have pushed for the adoption of primary health care as a strategy which was first mooted at Alma Ata for the prevention and promotion of basic health care services. This will address mostly all the health care determinants hence resulting in better health outcomes through the use of available resources effectively, efficiently and equitably (WHO 2018).

Trends in Health Expenditure in SADC



Source: Adapted from World Bank data

The trend as shown in the diagram indicates an upward movement in health expenditure per capita meaning naturally we expect improved health outcomes but apparently, the region still lacks in set targets for most indicators such as life expectancy, infant and maternal mortality rates. This is mainly due to problems in low investment in health, human resources gaps, lack of adequate health systems and infrastructure as well as medical drugs and sundries stock-outs. (World Bank 2016). The researcher intends to look at the impacts of these and other factors on life expectancy.

RESEARCH PROBLEM AND OBJECTIVES

Despite being signatories to most of the health commitments such as Alma Ata, Abuja declaration, SDGs and UHC, most of the countries in the SADC region still struggle to meet the targets. The regional average percentage

of government total health expenditure of GDP is 7.8% with US$163 per capita, this is far too short of the 15% Abuja target (WHO 2014). SADC members are highly burdened with HIV/AIDS, TB and malaria with 9 countries being with the highest HIV prevalence and 8 countries among the top 15 with a high TB incidence rate. Of the total SADC population, 75% risk on contracting malaria with the region also endemic to neglected tropical diseases (WHOAfro 2014, Leeven et al 2015).

The study will mainly focus on determinants in the SADC region which have a great impact on the health outcomes mainly being represented by healthy years of life from birth. This will help in channelling the available resources to the impact areas as well as reviewing what has been done in terms of results. Health needs a multi-sectorial approach and coordination since it is affected by many facets. The study aims to assess the impact of health services provision, economical-social and physical health determinants on life expectancy as the health outcome of choice. The following sub-objectives;

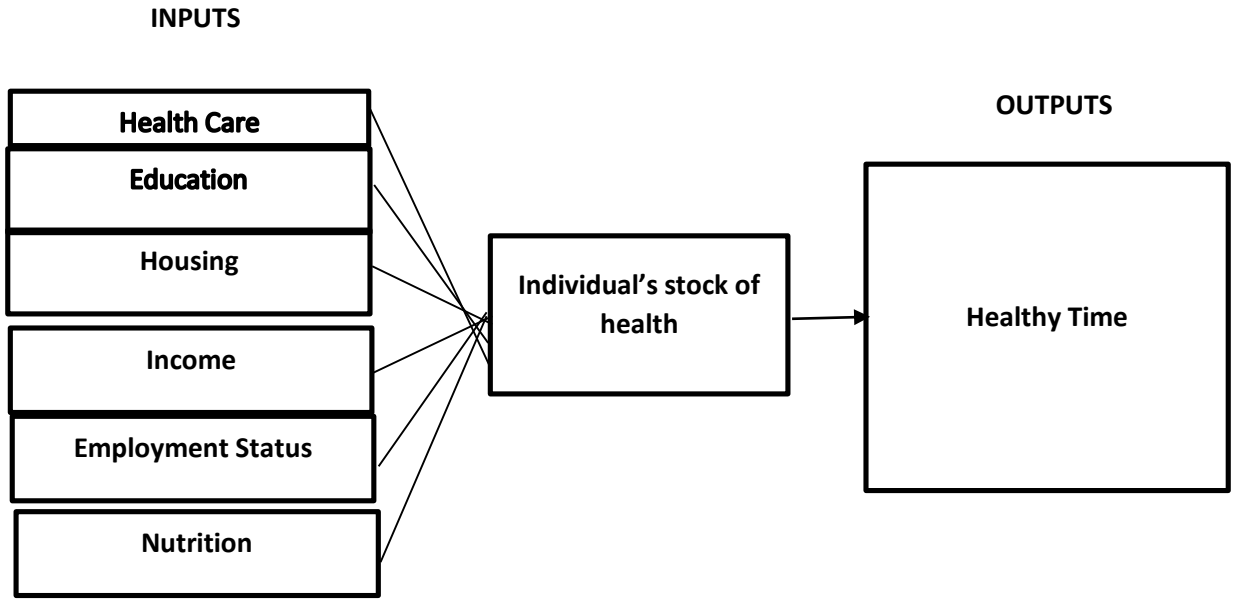
- To examine the impact of total government health expenditure on life expectancy
- To examine the impact of antiretroviral coverage as a percentage of people living with HIV on life expectancy
- To examine the effect of improved water source on life expectancy

II. THEORETICAL LITERATURE REVIEW

There are quite several theoretical models which described the health determinants concerning the outcomes. They are generally grouped in phases with the first phase a period before 1995 having the objectives of identifying determinants of health and establishing the relationship between them. The second phase a period 1995-2005, it was more on the classification of determinants and their relationships with the outcomes. The phase after 2005 now focussed more on addressing health inequalities through improvement in the socio-economic determinants of health (Hosseini shokouh s, 2017)

Grossman Model

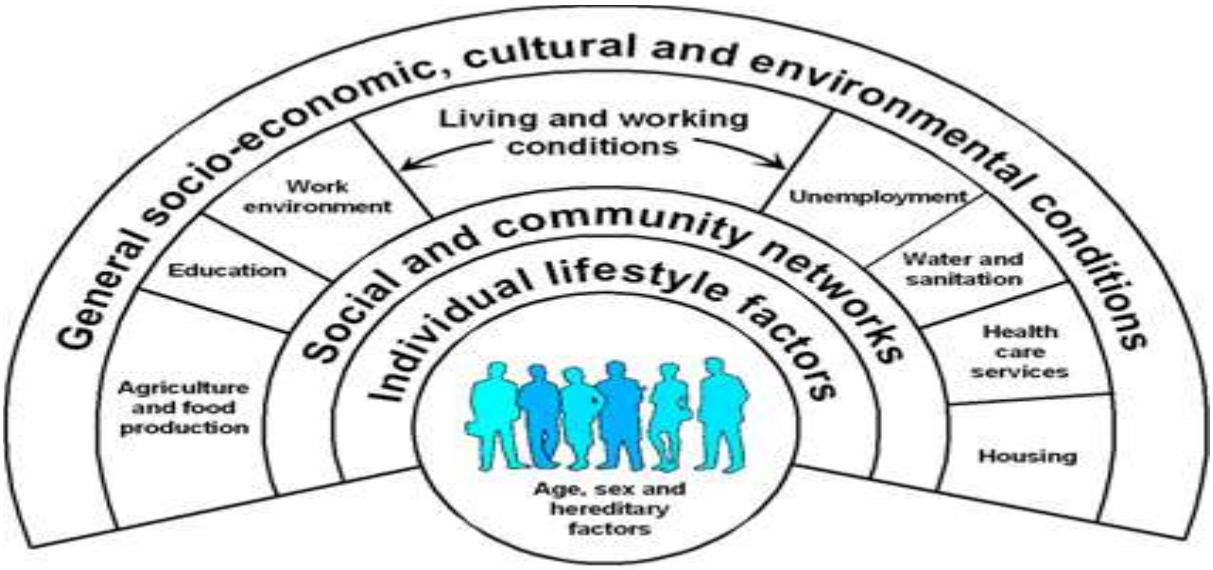
Grossman (1972) modelled how the individual chooses his/her level of health and therefore determines health outcomes especially looking at how long your life will last. Health is considered as a capital investment which depreciates over time. So health determinants now become the inputs which prolong the life span. So investments on determinants such as health care systems, healthy diet, physical exercises and other psycho-social factors will lead to better health outcomes such as increased life expectancy. This shows that health production depends on so many factors as shown in the diagram below as derived from the model.



2.1.2 Social Model of Health (Dahlgren and Whitehead (1991))

Dahlgren and Whitehead (1991) developed the social model of health which provides a framework used for the identification of main health determinants of health. The model extends to look at the macroeconomic issues and provision of essential goods and services, more specifically water and sanitation, food and healthcare. According to McDavid Harrison and Dean (2011) strength of the model is its ability to depict essential elements that lead to quality of health from a broader perspective covering health, agriculture, labour, education and social infrastructure.

Braveman P, Egerter S, Williams D.R (2011) argue that the model shape public health programs and policies at national, regional and global levels on how to access key determinants of quality health. Nations with more consistent welfare system tend to implement programs and policies that benefit all sections of the society which ultimately improve the quality of healthcare at the global level. The model has been used as a template for developing the implementation of public health policies at all levels of governance. It has been noted that nations that have implements policies that put the welfare of its citizens have ultimately improved the quality of health care at population levels. Health inequalities which are most common in developing countries are all because of failure to craft policies that covers the welfare of the majority. The model has been used by researchers to come up with hypotheses for determinants of health and to explore their effects on the health outcomes.



Source: WHO 2016

2.1.3 Wilber` Model

This model showed the link between psycho-social determinants of health and the health outcomes. It is a comprehensive model which depicts the four corners of the known universe referred to as "four faces of the Kosmos" (Kliger B, 2004). The four domains are interdependent, interconnected, interrelated and interactive. These are the characteristics of most of the health determinants.

Invisible interior -Psychological factors -feelings, attitude, beliefs	Exterior-physiological factors -organs, tissues, cells
Interior- Cultural -meetings, world views,	Collective exterior -Social structures, ecosystem

Source –created by Author

Health outcomes are positive when the psychological determinants like attitudes and feeling have been positive and also when negative, negative health outcomes have also been experienced. This means decisions that

have a positive effect on mind, body and spirit will eventually lead to a healthy lifespan. This auger well with the healthy definition which is the physical, spiritual, emotional and social well-being not just the absence of disease.

III. EMPIRICAL LITERATURE

Health indicators can be measured by the following proxies total expenditures on health per capita, health expenditure as % of GDP, number of physicians, number of hospital beds, improved sanitation facilities, improved water source, the prevalence of undernourishment, education (Baltagi and Moscone, 2010). In this study, we considered total health expenditures, antiretroviral coverage, improved water source. Health outcome indicators can be longevity indicators such as life expectancy (life expectancy at birth, life expectancy at 65 years, healthy life expectancy) for the total population and/or by gender or mortality indicators such as maternal and infant mortality rates. These are good proxies for measuring the quality of health at a population level (Cutler et al., 2006; Poças and Soukiazis, 2010). Studies have found that the greater the life expectancy in a country, the healthier its population is, so we considered life expectancy at birth as the outcome of choice.

Impact of health expenditure on health outcomes

Health expenditure is the value of resources allocated to improving and maintaining the health status of the population. This makes it one of the health determinants of society health outcomes Bayati et al (2013).In Africa through a study done by Anyanwu and Erhijakpor (2007), an increase of 10% in health expenditure resulted in a 22% decrease in infant mortality and 21% in under-five mortality. This confirms the significant effect of health expenditure as a determinant of health outcomes. These positive effects, have pushed African Union members states to adopt the Abuja declaration of allocating at least 15% of total governments expenditure to health. This set target`s main objective was to eventually improve the health outcomes of the African population. Though the majority are yet to meet the target, there is a steady growth in health expenditure and naturally through effective and efficient use of the resources better health outcomes are expected. At a global level, health financing is one of the six building blocks of Universal Health coverage policy. The main objective is to try and raise more resources to finance healthcare efficiently and equitably.Through that process, they will be an increase in health expenditure and hence better health outcomes World Bank (2016).

Impact of Antiretroviral coverage on life expectancy

There is literature that examines the relationship of antiretroviral ART coverage with life expectancy. ART coverage is defined as people reported to be on treatment at the end of the year divided by the estimated number of people living with HIV in the same year (Granich R, 2015) The introduction of different regiments of ART drugs was basically to prolong life by averting premature deaths due to HIV infections. There provision of ART to more than 6.2 million people in Sub-Saharan Africa served more than 9 million life-years, averted 4.8 million deaths between 1995-2013. This has increased life expectancy from around 50 years to 60 within from 2004 to 2012. So increased

ART coverage increased life expectancy and reduced new infections at the entire population level (UNAIDS, 2012) (Tanser F, 2013).

A study which was done in Canada and the US found a 20-year-old HIV positive adult on ART expected to live into their early 70s a life expectancy close to that of the general population (Samji H, 2013). This is supported by evidence which shows the introduction of ART improving survival chances among HIV positive patients and resulted in increased lifespan. This has positive benefits to both the individual and society at large in terms of health outcomes (Collaboration, 2008). So from the literature, it is evident that increasing coverage of ART on those living with HIV/AIDS will result in increased lifespan hence life expectancy.

Impact of improving water source on health outcomes

Empirical literature available shows the necessity of safe drinking water as a measure to prevent disease outbreaks and also maintain good health. This was supported UN 2010 who declared water as a human right. By so doing it becomes mandatory for all governments to put policies that improve the provision of safe drinking water to its citizens. Van Maanen (2010) reveals that the provision of water and sanitation is effective in improving health outcomes and they uses child mortality as the proxy. A decrease in child mortality will result in an increased life expectancy. Lack of water and sanitation provision is reported to have caused around 870 000 deaths in 2106 (WHS 2018). Improved water source has an impact of a decrease in waterborne diseases mainly diarrheal disease such as cholera and dysentery which are the major contributors of child mortality.

IV. METHODOLOGY

The study considers 11 of the 16 SADC countries. Secondary panel data of the period 2000-2015 from the World Bank was used for the study. Health outcomes were proxied by life expectancy from birth and current health expenditure per capita (US$), Antiretroviral coverage as a percentage of people living with HIV as well as an improved water source as a percentage of the population were considered as independent variables. Diagnostic tests, unit root test, autocorrelation, multicollinearity and heteroskedasticity were done for model fitness. Ordinary Least squares (OLS) method was then employed for estimation of the model.

Empirical model

Study model defines Life expectancy at birth as a function of current total health expenditure per capita, antiretroviral coverage as a percentage of people living with HIV and improved water source as a percentage of the population. This can be represented in the below model

$$LEB = f(CHE\ ,\ ARTC,\ IWS)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (1)$$

This can be estimated in a linear form as shown below

$$LEB = \beta 0 + \beta 1 CHE + \beta 2 ARTC + \beta 3 IWS + u \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

CHE- current health expenditure per capita (US$)

ARTC-Antiretroviral coverage as a percentage of people living with HIV

IWS – Improved water source as a percentage of the population

β0- constant

β1-3 –vector parameters

DEFINITION AND JUSTIFICATION OF VARIABLES IN THE MODEL

Dependent Variable

Life expectancy at birth (LEB) is the dependent variable and is defined as the number of years that a baby born in a given year can be expected to live if age-specific death rates do not change (AIHW, 2016) Life expectancy at birth was considered as the proxy of health outcome since it encompasses all other measured outcomes such as infant mortality and maternal mortality. It considers all deaths rates of all age groups. The major challenge though faced by other considered health outcomes is to look at life as a quantity and not considering the quality side. On this case indicators such as quality of life adjusted years, could have been more appropriate but unfortunately, there is no data available.

Independent variables

Current health expenditure per capita (CHE) is the sum of all health expenditures including public and private divided by the total population. It is measured in US$ for uniformity purposes. Several studies have found that it is a major determinant of health outcomes specifically LEB. It was considered as the indicator of choice because of its inclusivity of all other health expenditures. The major challenge comes from the equity side of health expenditure. CHE assumes every other individual gets an equal share of the cake, which in reality it is not the case. There are high inequalities of healthcare resources distribution among demographic, regional, levels of care as well as between health services. Naturally increased health care expenditure will result in improved healthcare hence decreased disease mortalities and morbidities. This will increase life expectancy.

Antiretroviral coverage is defined as the number of people on treatment at the end of the year divided by the estimated number of people living with HIV in the same year. This was chosen so as a measure of the health system indicators. More someone to be on ART treatment, he /she has to go through the health system from access,

affordability and efficiency. The chain starts from investigations, diagnosis, treatment, monitoring and evaluation. This indicator shows the importance of the health systems to a health outcome. Increased on ART coverage, means an increased life expectancy since literature supports it has reduced deaths from HIV related illness (UNAIDS, 2012) (Collaboration, 2008).

Improved water access as a percentage of the population measures the proportion of households with access to clean water for drinking and all other hygienic purposes. Water is life the body needs it for hydration as well as for hygienic purposes such as washing hands to promote good health. Lack of proper water and sanitation has resulted in increased mortality rates for under 5 years mostly due to waterborne diseases. Sporadic outbreaks of diarrheal diseases such as cholera and dysentery have resulted in the loss of life. So improved water sources will eventually result in decreased mortalities and disease outbreaks. This will result in increased life expectancy due to the improved health of the citizens

DIAGNOSTIC TESTS

The following tests were done to check the fitness and robustness of our model

1. Unit root test
2. Autocorrelation
3. Multicollinearity
4. Heteroskedasticity

ESTIMATION PROCEDURE

The Ordinary Least Square regression model was used for estimation of equation 2 above. Panel data was run on Stata software

Data sources and problem

Secondary data used was derived from Wold Bank Data indicators 2018. The first challenge was missing data on some indicators with Zimbabwe missing data on Health expenditure per capita for about 10 years from 2000. This challenge of data gaps has even forced the system to drop other variables that have been considered. Data compilation is still a challenge on other key health indicators within the region and in some cases, estimates are used which result in reduced quality of data. As for the data gaps, the system extrapolates.

V. RESULTS

Table 1: Descriptive summary

```
. xtsum
```

Variable		Mean	Std. Dev.	Min	Max	Observations
Countr~e	overall	.	.	.	.	N = 0
	between		.	.	.	n = 0
	within		.	.	.	T = .
Time	overall	2007.5	4.622924	2000	2015	N = 176
	between		0	2007.5	2007.5	n = 11
	within		4.622924	2000	2015	T = 16
Lifeex~l	overall	53.56014	5.083965	44.109	65.846	N = 176
	between		2.6761	49.34013	57.11488	n = 11
	within		4.393067	45.15702	63.71183	T = 16
Curren~c	overall	152.7303	162.0123	4.487285	597.3594	N = 166
	between		149.565	11.67982	392.1739	n = 11
	within		69.86799	-70.42139	357.9159	T-bar = 15.0909
People~n	overall	60.10044	16.45659	22.2128	84.69727	N = 176
	between		16.80502	34.51594	80.97492	n = 11
	within		3.552084	47.7973	72.84324	T = 16
Antire~e	overall	20.45455	21.84408	0	76	N = 176
	between		9.052628	7.6875	34.4375	n = 11
	within		20.05587	-13.98295	66.07955	T = 16
countr~m	overall	7.337079	3.935766	1	13	N = 178
	between		3.89444	1	13	n = 13
	within		0	7.337079	7.337079	T-bar = 13.6923
time	overall	91	52.39434	1	181	N = 181
	between		54.99532	8.5	180	n = 14
	within		4.559483	83.5	98.5	T-bar = 12.9286

.

Table.1 above shows there were 176 observations made for all the variables except the current health expenditure with 166 observations made because of the gaps with Zimbabwe data. Other descriptive statistics which are the observational range, mean and standard deviation are also shown on the table

DIAGNOSTICS TESTS

Table 2: Unit root test

Unit root test was tested using the Levin-Lin-Chu test with our p-value approximately zero hence we reject our null hypothesis meaning our panels variable was stationary.

```
. xtunitroot llc Lifeexpectancyatbirthtotal, lags(1)

Levin-Lin-Chu unit-root test for Lifeexpectancyatbirthtotal
-------------------------------------------------------------

Ho: Panels contain unit roots              Number of panels  =     11
Ha: Panels are stationary                  Number of periods =     16

AR parameter: Common                       Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 8.00 lags average (chosen by LLC)
------------------------------------------------------------------------------
                 Statistic      p-value
------------------------------------------------------------------------------
 Unadjusted t      -20.5937
 Adjusted t*       -21.5843       0.0000
------------------------------------------------------------------------------
```

Table 3: Multicollinearity

```
.
------------------------------------------------------------------------------
```

```
. vif

    Variable |      VIF       1/VIF
-------------+----------------------
Peopleusin~n |     2.30    0.434970
Currenthea~c |     2.29    0.437181
Antiretrov~e |     1.32    0.758698
-------------+----------------------
    Mean VIF |     1.97
```

Multicollinearity measures how independent our variables among themselves. In our study, the value is less than 10 meaning their variance in our dependent variable is explained independently by each variable.

Table 4: Autocorrelation

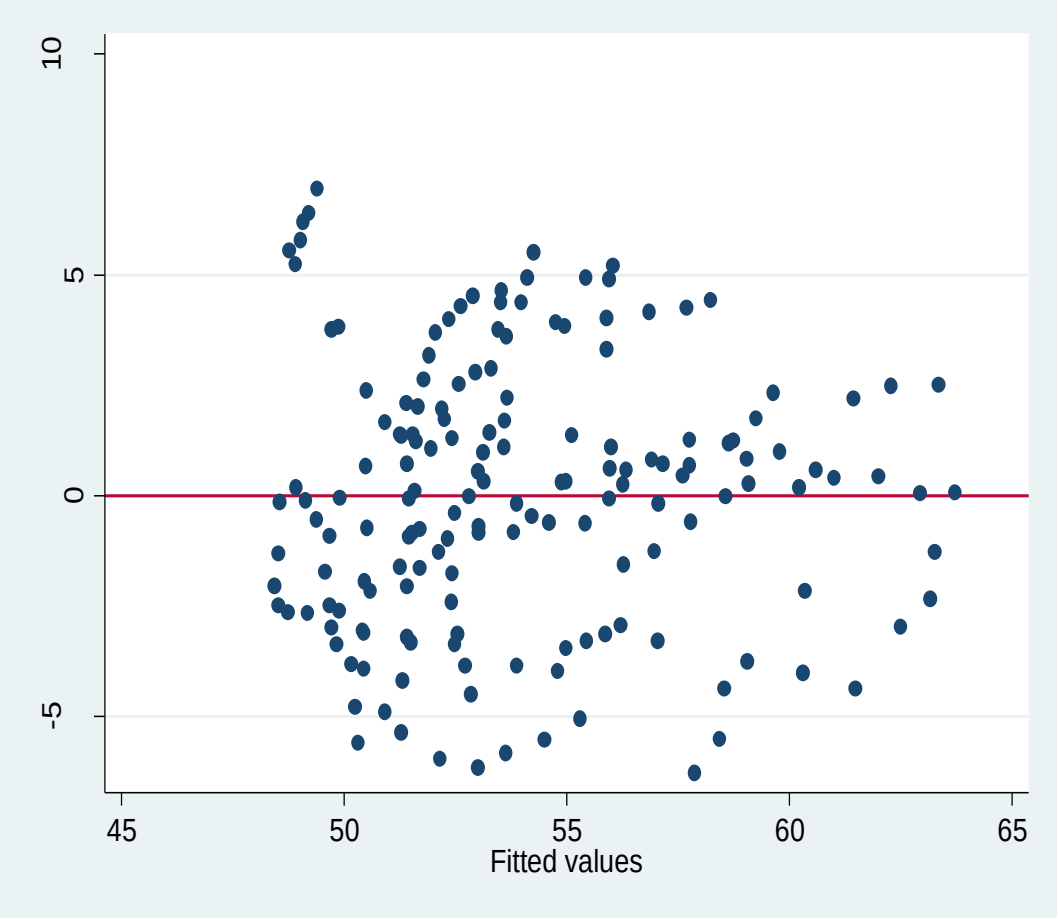
Breusch-Godfrey LM test for autocorrelation

lags(p)	chi2	df	Prob > chi2
1	128.610	1	0.0000

H0: no serial correlation

The test above gives us a chi^2 of less than 0.05 hence we reject the null hypothesis. That means there is a serial correlation which has to be corrected before data is regressed to remove bias with our error term.

Table 5: Heteroskedasticity



Source: Stata output

Table 5 above shows how scattered are the residuals but if we to draw an estimate line, the majority of the plots follow more or less the same margin. It shows the variability of our model

Table 6: Estimation of results

```
. regress Lifeexpectancyatbirthtotal Currenthealthexpenditureperc Peopleusingatleastbasicdrin Antiretroviraltherapycoverage

      Source |       SS       df       MS      Number of obs   =       166
-------------+------------------------------   F(3, 162)       =     83.19
       Model |  2360.42317     3  786.807725   Prob > F        =    0.0000
    Residual |  1532.21526   162  9.45811886   R-squared       =    0.6064
-------------+------------------------------   Adj R-squared   =    0.5991
       Total |  3892.63843   165  23.5917481   Root MSE        =    3.0754

------------------------------------------------------------------------------
Lifeexpectancyatbirthtotal |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------------------------+--------------------------------------------------------------------
Currenthealthexpenditureperc |   .0099162    .002235     4.44   0.000     .0055027    .0143297
Peopleusingatleastbasicdrin |  -.1013791   .0216422    -4.68   0.000    -.1441162    -.058642
Antiretroviraltherapycoverage |   .1647184   .0124452    13.24   0.000     .1401427    .1892941
                     _cons |   54.99813   1.067173    51.54   0.000     52.89077    57.1055
------------------------------------------------------------------------------
```

Table 6 above will make us estimate our equation 2 model as shown below

$$\boldsymbol{LEB = 54.99813 + 0.099162CHE + 0.1647184ARTC + (-0.1013791)IWS + u} \dots\dots\dots\dots\dots\dots (2)$$

Our observations have dropped from176 before regression to 166 due to the data gaps. F- Value is approximately zero showing that our model overall fit. The R^2 value is 0.6064 which means 60.64% change in Life expectancy at birth is being explained by our independent variables in the model. P-Values for all our independent variables are approximately zero at 95% confidence intervals hence they are statistically significant in explaining changes in our dependent variables. That means we fail to reject our null hypothesis for all the variables. Overall this shows our model to be reliable and valid for our estimation.

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VI. RESULTS INTERPRETATION AND DISCUSSION

From the results above, all the considered independent variables explain changes in our dependent variable which is life expectancy. A unit change in current health expenditure per capita results in 0.099162 positive change in life expectancy at birth. The sign of the coefficient is positive and this is consistent theoretical and empirical literature as well as our hypothesis. Increased health expenditure improves both the preventive and curative aspect of health. This will result in declining mortality rates and disease burden. So ultimately people live longer and hence increase in life expectancy.

Antiretroviral coverage as a proportion of people living with HIV is statistically significant with a positive coefficient. Therefore, a unit change in it will result in 0.1647184 change in life expectancy at birth. Literature shows that HIV/AIDS-related deaths have been high in the SADC region. So the introduction of ARV has greatly improved the life chances of HIV patients by suppressing viral levels hence preventing deaths. Increase in coverage to those on people living with HIV will result in reduced deaths, increased quality of life and hence raining up the life expectancy. This is also consistent with our null hypothesis.

Improved water supply source is statistically significant with the coefficient sign being negative. This is not consistent with the literature and our hypothesis which says improved water supply should result in increased quality of life and hence life expectancy

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