Public Health Spending and Health Outcomes: What Are the Strategic Implications for The SADC Region?

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Abstract: - A well-funded health system is essential to protect people from the financial burden of sickness and allows for efficient responses to public health concerns. It increases the capacity to provide early and preventative interventions, thus being cost-effective. The study objective is to evaluate the effect of public health spending on health outcomes. Specifically, the effect of public health spending on life expectancy at birth and infant mortality. The study utilised the autoregressive distributive lag (ARDL) model to determine the link. The study incorporates economic growth, technological advancement, foreign aid and corruption as the moderating variables. The results established that government health spending spurs health outcomes by increasing life expectancy and reducing infant mortality rates. The study established that health outcomes are positively influenced by technological advancement, economic growth and foreign aid. Corruption negatively affects health outcomes. The study recommends strong budgetary support to the health sector, anti-corruption laws and pro-growth policies.

Key-Words: - Health outcome, Government Health Spending, Technology, Corruption, Foreign Aid, Life expectancy, Autoregressive Distributed Lag.

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1 Introduction

Health systems play a significant role in improving human wellbeing and health outcomes. They are also essential to the economy's efficient operation. Health systems boost productivity and the labour supply by promoting better health. Furthermore, when considered as economic sectors, health systems generate commodities and services that directly support economic growth and are a significant source of employment. There are several other beneficial externalities associated with well-functioning health systems, particularly economic and health security. Problems, including excessive air pollution, lack of clean water, and socioeconomic factors like poverty and a poor education system, negatively impact health systems. In order to address these problems, more money must be spent on healthcare quality to address poverty and pollution. The essence of the health system is evident from the amounts that governments have been investing in the sector. Government spending on health constitutes a major expense on government budget. It is no surprise that countries have been collaborating to try and find funding mechanisms for the health sector. The African Union (AU) member nations committed to strengthening their African Development Community member states by allocating at least

15% of their annual national budgets through the Abuja Declaration of 2001, [1]. Compared to other developing regions, sub-Saharan Africa (SSA) is riddled with worse health outcomes, with lower life expectancy, high rates of maternal and newborn mortality, and a high incidence of infectious diseases like HIV/AIDS, malaria, and tuberculosis. Poor healthcare infrastructure and services, low health spending, social determinants like poverty and education, and environmental problems like high air pollution and restricted access to clean water are important variables affecting health outcomes. More funding for healthcare, better access to and quality of healthcare, and initiatives to fight poverty and environmental pollution are all necessary to address these problems.

Several empirical studies have analysed the relationship between government spending and health outcomes, [2], [3], [4], [5], [6], [7], [8], [9], [10]. Most of the studies have established that government health spending is strongly linked to favourable health outcomes, such as longer life expectancy and lower mortality rates, particularly for infants and children under five. [2], [3], [4], [5], [6]. The relationship has been analysed and the results proffer different perspectives, with [11] establishing that increased income per capita and enhanced government support improve the health outcomes of the citizens of the country. The study further found that increased government spending for mother-child health services lowers maternal and infant mortality and improves life expectancy at birth, [11]. In a similar study, it was revealed that the type of healthcare spending, the specification of the health production function, and data aggregation all have a significant impact on the life expectancy elasticity, [12]. A positive correlation has been established between health care spending and female and male life expectancy, [13]. The study further established that health spending had a greater effect in enhancing the life expectancy in females as compared to males, [13]. In a study in the OECD, [14] deduced that health expenditures had a positive and significant effect on life expectancy, denoting the influence of public health spending on the long lives enjoyed by the citizens of OECD countries, [14]. Sub-Saharan Africa, which is characterised by high mortality and lower life expectancy, has also been investigated and the results also show that government health expenditure reduces the under 5 and infant mortality rates and conclude that public resources have not been utilised for the benefit of reducing infant mortality because of high corruption levels and fungibility of government spending on health in sub-Saharan African countries, [15]. Similar studies indicate that health spending only significantly improves child health status in high-income and upper-middle-income countries, while it has no effect on child mortality in low-income and lower-middle-income countries, [16]. This is a direct contradiction to studies done by other scholars [2], [3], [4], [5], [6]. For example, [17] asserts that health care spending by governments remains a crucial component of health, reducing infant and neonatal mortality in sub-Saharan African countries, a region characterised by poor health infrastructure. In the SSA region, increased health spending by states will help reduce infant and neonatal mortality during the time governments are working towards Sustainable Development Goals, [17]. The major lessons coming from these studies are that government spending has a greater impact on general population health indicators, with special benefits in lowering mortality from diseases like HIV and tuberculosis, even when both public and private investment exhibit benefits. However, a nation's current healthcare system and how expenditures are used can affect how effective spending is; therefore, effective policy and resource management are essential for optimizing benefits, [4], [8], [9], [10].

The current study endeavours to answer the question of - Does health expenditure spur health outcomes? using the Southern African Development Community (SADC)as a case study. The SADC region is composed of sixteen countries. The region, like other regions in Africa, is experiencing insufficient investment in public health and poor access to health care, [1]. Facing mounting challenges in the health sector, each member country of the block committed to enhancing the health and well-being of its citizens. These members are committed to global and regional initiatives, including the United Nations Sustainable Development Goals and the Abuja Declaration. To this end, there is a need to evaluate whether governments' health spending helps improve health outcomes, specifically life expectancy at birth and infant mortality rates. Countries that can improve their health outcomes also enhance the social well-being of their citizens.

2 Methodology

The study assesses the role of government health spending on health outcomes. Specifically, the study evaluates how government spending affects life expectancy and the infant mortality rate. The study utilised the autoregressive distributive lag(ARDL)

model to determine the link between government health spending and health outcomes.

The ARDL model was adopted given its perceived benefits of simultaneously measuring both the short- and long-run relationships. Further, it has strong statistical power in small sample sizes, robust in data that is integrated of order zero and one. The method also includes a single equation framework and accounts for the endogeneity of independent variables. Two alternative estimators of panel ARDL analysis, the mean group and pooled mean group estimators, were applied to investigate the relationship between health outcomes and health spending. The pooled mean group allows for short-run coefficients, intercepts, speed of adjustments and error variance to be heterogeneous between countries, whereas long-run coefficients are homogenous between countries. On the other hand, the mean group, the regression for each country is separated both in the long-run and short-run and coefficients are computed as unweighted means for the estimated coefficient for each country. The Hausman test is utilised to ascertain the best model that can be used in the analysis through checking for a significant difference that may be present between the pooled mean group (PMG) and the mean group (MG). The null hypothesis is that there is no significant difference between the two. If the p-value is less than 5%, the null hypothesis will be rejected.

The ARDL model for the study is specified in equation 1. The equation incorporates both short-run and long-run dynamics of the variables.

$$\begin{aligned}\Delta \text{Outcome}_t &= \alpha_0 + \alpha_1 Outcome_{t-1} + \alpha_2 \text{GHE}_{t-1} + \alpha_3 \text{GDP}_{t-1} \\ &+ \alpha_4 \text{TEC}_{t-1} + \alpha_5 COR_{t-1} + \alpha_6 FOA_{t-1} \\ &+ \sum_{t=1}^{p} \mu_t \Delta Outcome_{t-1} + \sum_{t=1}^{p} \vartheta_t \Delta GHE_{t-1} \\ &+ \sum_{t=1}^{p} \theta_t \Delta GDP_{t-1} + \sum_{t=1}^{p} \varphi_t \Delta TEC_{t-1} \\ &+ \sum_{t=1}^{p} \varsigma_t \Delta COR_{t-1} \\ &+ \sum_{t=1}^{p} \delta_t \Delta FOA_{t-1} \qquad (1)\end{aligned}$$

where α_1 to α_6 are long-run parameters and $\theta, \vartheta, \mu, \varphi, \omega$ and ϵ are short-run parameters. The model hypothesizes that there is no cointegration [$\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6$] and in case this fails, the alternative is $[\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6]$, implying there is cointegration. When the null hypothesis is rejected based on the F-statistic, it implies there is cointegration. The outcome variables are life expectancy (*LIF*) and infant mortality (*MOR*).

The study incorporates economic growth (*GDP*), technological advancement (*TEC*), foreign aid (*FOA*) and corruption (*COR*) as the moderating variables. The data for this study were obtained from the World Economic Indicators, and it covers the period 2010-2022, specifically for the SADC countries. The period includes the time when the global economy was affected by the Covid 19 pandemic.

3 Results and Discussion

This section presents the results of the study. The section starts by presenting the descriptive statistics of the variables, the correlation matrix and the unit root tests results. This is then followed by the presentation and discussion of the ARDL short and long-run results, followed by the robustness tests shown by the fully modified ordinary least squares (FMOLS) method. The descriptive statistics for the variables used to estimate the determinants of health outcomes equation are presented in Table 1.

Table 1. Descriptive Statistics

Variable	Mean	Std. Dev	Min	Max	Obs
GHE	105.134	145.512	1.324	620.392	208
GDP	3.532	4.283	-14.547	21.452	208
TEC	27.697	6.9000	13.900	46.85	208
COR	0.700	1.213	-1.425	2.334	208
FOA	8.509	9.670	0.001	55.265	208
LIF	62.273	5.973	46.045	77.236	208
MOR	42.7293	14.884	12.600	76.100	208

Source: Authors' own compilation

The descriptive statistics of the study, composed of the mean, maximum, minimum and the standard deviation of the variables, are presented in Table 1. The variation of the data set is minimal, as reflected by the low standard deviations of the variables except government health expenditure and infant mortality rate. According to the results, the average annual government health expenditure per capita in the SADC region (*GHE*) is \$105, with the maximum expenditure per person being \$620. Growth rates (*GDP*) over the period 2010-2022 averaged 3.53 percent, while the highest level of growth recorded by one of the countries was 21.45 percent during the period. The life expectancy at birth (*LIF*) was on average 62 years, while infant mortality (*MOR*) was 43 deaths per 1000 newborn

babies. Technological expenditure (*TEC*), a proxy for technological advancement, ranged between $13.90 - $46.85 per person during the study period, a figure low compared to other regions in the world. Foreign aid (*FOR*) averaged $8.509 per annum. Corruption perception index (*COR*) averaged 0.7, a higher figure given that this index ranges from 0 to 1. This shows the levels of corruption are quite high in the region, which could impact health outcomes. The correlation matrix is presented in Table 2.

Table 2. Correlation Matrix

	GHE	TEC	GDP	COR	FOA
GHE	1				
TEC	0.6113	1			
GDP	-0.0223	-0.0442	1		
COR	-0.0195	-0.0162	-0.1230	1	
FOA	-O.3839	-0.2177	0.2127	0.1547	1

Source: Created by authors

In order to ensure the model adopted does not suffer from multicollinearity, the study evaluated the correlations among the dependent variables. These are presented in Table 2. To avoid the problem of multicollinearity, the correlation coefficient should be below 0.8, [18]. The results show that the correlation coefficients do not exceed 0.8, showing that there is little to moderate correlation among the independent variables.

In order to ascertain if there is long run equilibrium relationship among the dependent and independent variables, the cointegration test is undertaken. The results are presented in Table 3. The results are important since they assist in mitigating the risk of spurious regression, especially when variables are moving in the same direction but are not related.

Table 3. Cointegration Test

		Dep: MOR		Dep: LIF	
Test		Statistic	P-Value	Statistic	P-Value
Pedroni Test	Modified Philip Peron t	5.8221	0.0000	5.6477	0.0000
	Philip Peron t	-1.9358	0.0264	-1.8732	0.0305
	Augmented Dickey Fuller	-3.2408	0.0006	-4.2746	0.0000
Westerlund	Variance Ratio	6.9391	0.0000	4.6259	0.0000

Source: Created by authors

The results of the cointegration test presented in Table 3 show that the independent variables and the dependent variable are cointegrated. This means that there are long-run relations between the health outcomes and economic growth, government health expenditure, foreign aid, technological advancement and corruption. The establishment of the long-run relationships paves the way for the ARDL regression to be estimated. Table 4 presents the ARDL regression results.

Table 4. ARDL Regression Results

	Dep: MOR		**Dep: LIF**	
LONG RUN EQUATION				
	Coefficient	P-Value	Coefficient	P-Value
GHE	-0.5847	0.011	0.9188	0.000
GDP	-0.1579	0.008	3.5113	0.000
TEC	1.0768	0.000	0.5110	0.000
COR	2.0206	0.000	-4.1531	0.009
FOA	-0.0335	0.064	0.0938	0.099
SHORT RUN EQUATION				
ECM	-0.060	0.025	-0.0680	0.001
GHE	-0.0046	0.562	-0.0372	0.126
GDP	-0.0022	0.937	-0.2112	0.000
TEC	-0.0355	0.448	-0.0136	0.555
COR	1.1709	0.622	-0.4081	0.782
FOA	-0.4602	0.105	0.3795	0.452
CON	-1.2859	0.314	-2.0752	0.026

Source: Created by authors

The long-run and short-run results are reported in Table 4. The coefficient on the lagged error correction term for both the life expectancy and infant mortality rates is significant with the correct sign, supporting the evidence of a stable long-run relationship among the variables. The mortality model coefficient suggests that when disequilibrium occurs, 6 percent of the disequilibrium is corrected in the following periods. When disequilibrium occurs in the life expectancy model, 7 percent of the shock is corrected in the following period.

There is a positive and strong correlation between life expectancy and public health spending, or the total amount of money set aside by the government for health. This supports the notion that better health outcomes are achieved as health spending rises. When life expectancy rises, government facilities will be equipped with the necessary tools and drugs. Likewise, a good and significant part of health outcomes is the decrease in infant mortality brought about by increased government funding. The call made by the Abuja Declaration for governments to at least allocate 15 percent of their budget should be adhered to by the countries that have been falling short of this requirement. The findings are consistent with earlier research [3], [4], [5], [6].

Table 4 shows that economic growth is positively related to life expectancy and negatively

related to the infant mortality rate. This means that as economies grow, life expectancy at birth for the citizens increases while infant mortality declines. The results imply that health outcomes are positively influenced by economic growth, i.e., as countries enjoy sustained growth, the health outcomes improve with life expectancy going up and infant mortality declining. In general, economic expansion enhances health outcomes by raising earnings, which facilitates improved access to sanitary conditions, healthcare, and nutrition. These results are in sync with previous studies, which established that growth enhances health outcomes, [19], [20], [21], [22].

Life expectancy is positively impacted by technology, but infant mortality is negatively impacted. According to the findings, technological advancements raise life expectancy while simultaneously lowering the birth rate of infants. Both the short and long term are affected by this. Technologies that improve healthcare and delivery, such as digital health platforms and immunization delivery systems, result in decreased infant mortality rates at birth (MOR) and longer life expectancy (LIF) at birth. Both the general population and medical professionals benefit from technology. Technology speeds up the development and delivery of medications, improving national health systems. For instance, the COVID-19 pandemic demonstrated that nations with advanced technology were at the forefront of finding treatments for the illness, which resulted in a decrease in the number of fatalities from the disaster. Several research findings established the same results [23], [24], [25].

The results show that corruption negatively affects health outcomes. In this case, corruption reduces life expectancy and increase infant mortality rate. This shows that corruption is bad for health outcomes because it results in ineffective and uneven access to services, lowers quality, and results in the loss of money intended for public health. It can take the form of bribery, which causes patients to pay more for care and allows counterfeit or inferior medications to enter the supply chain. Nearly $455 billion of the $7.35 trillion spent on health care worldwide each year is lost to fraud and corruption, according to [26]. According to the OECD, 45 percent of people worldwide think that the health sector is corrupt or extremely corrupt. Corruption is partially to blame for around 140,000 deaths worldwide each year, or 1.6 percent of all deaths in children under the age of five. According to estimates from [27], corruption accounts for 7.3% of global health spending.

The results have shown that foreign aid has a negative effect on infant mortality and a positive effect on life expectancy. This means foreign assistance coming into the country is bringing improvements in the health outcomes. Through financing important initiatives, supplying necessary pharmaceuticals, and fostering the growth of healthcare systems, foreign aid improves health outcomes. Through programs like antiretroviral treatments and immunization campaigns, foreign aid has played a significant role in the fight against diseases including HIV/AIDS, TB, and malaria. The study results are in line with other studies [28], [29], [30].

The robustness check was done using fully modified least squares regression. The results are presented in Table 5.

Table 5. Fully Modified Least Squares Regression

	MOR		LIF	
Variable	Coef	P-Value	Coeff	P-Value
GHE	-0.0282	0.0649	0.0533	0.0439
GDP	-0.6902	0.0000	0.3736	0.0000
TEC	-0.4097	0.0002	0.1942	0.0001
COR	1.4407	0.6027	-0.3999	0.7492
FAID	0.2357	0.1031	0.0849	0.0191
R-Squared	0.9184		0.8967	
S.E regression	4.3641		1.9581	
Long-run variance	25.7258		5.2571	

Source: Created by authors

The results in Table 5 mirror those presented in Table 4. This means that the results discussed above are robust and can be relied upon. The results show that government health expenditure, economic growth, technology and foreign aid enhance health outcomes. This means that an improvement in these variables will increase the life expectancy at birth and reduce infant mortality. Enhancing health outcomes is crucial because it improves people's and communities' quality of life, lowers healthcare costs through improved prevention and management, and promotes social well-being by boosting productivity and fostering healthier settings.

4 Conclusion

The SADC region has been experiencing several challenges in the funding of the health system. The countries in the region have committed themselves to regional and international agreements that call for enhanced financing of the health systems. The UN

Sustainable Development Goals and the Abuja Declaration are two main commitments signed by the regional countries. None of the countries seems poised to achieve these commitments, given the limited funding for the health sector. The study established that government health funding has a positive impact on the health outcomes of life expectancy and the infant mortality rate. Other factors impacting positively on the health outcomes in the SADC region are technological advancement, foreign aid, and economic growth. Corruption negatively affects health outcomes; in other word it reverses the gains of the health sector. The study therefore recommends that SADC countries should increase their budgetary allocations to health and, if necessary, at a minimum, meet the Abuja declaration commitment of at least 15 percent of their national budgets. There is a need for the states to institute or strengthen their pro-growth policies to increase incomes, which also enhances health outcomes as people's ability to buy health services is improved. Policies that enhance technological development and those that encourage foreign aid should be enhanced to encourage the use of technology and the inflow of funds to the health sector from other jurisdictions. Anti - corruption laws and regulations should be improved, including the automation of the health processes. Corruption reporting mechanisms should be instituted in the health institutions to arrest the culprits and bring them to book.

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