

## ORIGINAL RESEARCH ARTICLE

# The Impact of Healthcare spending on Life Expectancy: Evidence from Selected West African Countries

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Elizabeth Yinka Sango-Coker<sup>1\*</sup> and Murad A. Bein<sup>2</sup>

Department of Business Administration, Faculty of Economics and Administrative Sciences, Cyprus International University, Lefkosa, North Cyprus, via Mersin 10, Turkey<sup>1</sup>; Department of Accounting and Finance, Faculty of Economics and Administrative Sciences, Cyprus International University Lefkosa, North Cyprus, via Mersin 10, Turkey<sup>2</sup>

\*For Correspondence: Email: [mattbenny2000@yahoo.com](mailto:mattbenny2000@yahoo.com); [20150076@ciu.edu.tr](mailto:20150076@ciu.edu.tr); Phone: +15875908892

## Abstract

Increasing healthcare expenditure in West African countries cannot be over-emphasized. There is need for urgent improvement of healthcare, healthcare equipment and facilities, and human resources with qualified healthcare givers. It is important to have clarity on which healthcare sector to invest in, to maximize impact, effectiveness and efficiency. This study investigated the private, public, and public-private healthcare sectors of West Africa. Data was obtained from World Bank Indicators within the period of 16 years (from 1999 - 2014). Using pooled regression and pairwise correlation, empirical results were obtained. Female population lived longer than the male population and a positive relationship was obtained between the variables of healthcare spending and life expectancy for the public healthcare sector. The results showed a negative relationship between these variables for the private healthcare sector. The government, policy and decision-makers are recommended to focus on increasing the expenditure on the public healthcare system to achieve positive outcomes for increased life expectancy against other healthcare sectors that remain expensive and inaccessible to the population. (*Afr J Reprod Health 2018; 22[4]: 64-71*).

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**Keywords:** Healthcare, Expenditure, Life Expectancy, Population; West Africa, Private, Public, Male, Female

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## Résumé

L'augmentation des dépenses de santé dans les pays d'Afrique de l'Ouest ne saurait être trop soulignée. Il est nécessaire d'améliorer d'urgence les soins de santé, les équipements et installations de soins de santé, ainsi que les ressources humaines avec des prestataires de soins de santé qualifiés. Il est important de savoir clairement dans quel secteur de la santé investir, afin de maximiser l'impact, l'efficacité et l'efficacité. Cette étude a examiné les secteurs de la santé privés, publics et publics-privés en Afrique de l'Ouest. Les données ont été obtenues à partir des indicateurs de la Banque mondiale sur une période de 16 ans (de 1999 à 2014). En utilisant la régression groupée et la corrélation par paires, des résultats empiriques ont été obtenus. La population féminine a vécu plus longtemps que la population masculine et une relation positive a été établie entre les variables des dépenses de santé et l'espérance de vie du secteur de la santé publique. Les résultats ont montré une relation négative entre ces variables pour le secteur privé de la santé. Il est recommandé que le gouvernement, les décideurs et les décideurs politiques s'emploient à augmenter les dépenses consacrées au système de santé public afin d'obtenir des résultats positifs en augmentant l'espérance de vie par rapport à d'autres secteurs de la santé qui restent coûteux et inaccessibles à la population. (*Afr J Reprod Health 2018; 22[4]: 64-71*).

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**Mots-clés:** Soins de santé, dépense, espérance de vie, population; Afrique de l'Ouest, privé, public, homme, femme

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## Introduction

West African countries are low income countries, with much of the population not having health insurance. Payment for health services is informal, making up 10% to 45% of spending that is out-of-pocket for health services received<sup>1,2</sup>.

These informal payments compromise the input that government assumes will enhance affordable healthcare services intended for low income earners<sup>3</sup>. Sometimes patients are willing to pay more to receive quicker and better-quality service, but then not all can afford the bills of private healthcare centers<sup>4</sup>. Most of the countries in West

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Africa are categorized by the Human Development Index to be in the low-medium life expectancy category, majorly affected by the high degree of disease burden suffered in this region, especially malaria which is financially draining to the economy costing over 132 billion dollars per year in the region<sup>1,5</sup>.

Healthcare sectors can positively improve when reforms of policy spending are regulated, leading to different ways in which healthcare services are delivered, accessed, financed, utilized, and implemented<sup>6</sup>. This study investigated the impact of increased healthcare expenditure across several sectors of the healthcare system, namely the private, public, and combination of both, known here as the public-private partnership on total population.

### ***Literature review***

Life expectancy is length of years people usually live before death, not because of accident or injury, but shows that at a certain age in that population, people die<sup>7</sup>. Life expectancy can estimate average years of living of a nation, if the men live longer than the women and other factors. Human Development Indices (HDI) life expectancy rate at birth is calculated using maximum value of 83 years and minimum value of 20 years. For a country with life expectancy birth rate at 55 years, 0.551 would be the life expectancy rate<sup>7,25</sup>.

Life expectancy figure varies from place to place due to differences in factors affecting their healthcare systems. It is important to consider each environment under investigation individually during research investigations. In 2015, Global Burden Disease (GBD) reported that life expectancy can be affected by changes in growth rate and aging as well as other factors, leading to epidemiological changes in strong relation to socio-cultural, demographic, and rapid changes occurring in the environment<sup>7</sup>. The Socio-Demographic Index (SDI), which is relative to increased healthcare expenditure input, lowers the burden on humans caused by communicable and non-communicable diseases, which directly affects the level of life expectancy<sup>7</sup>. From 2005 to 2015, life expectancy increased by 2.9 years on average for men, 3.5 years for women, and 0.8 years on

average for people above 65 years of age<sup>7</sup>. GBD 2015 reported that every population's health state can be categorized in one of two ways: health gaps and health expectancies. To determine life expectancy is to take into consideration the summary of the healthy population, taking account the numbers of years, they have lived.

Due to vast changes occurring in West African countries, the calculated life expectancy is easily altered. High rates of fatal diseases that have not occurred for a long time are springing up suddenly, and altering the health state of the population, one of which was the occurrence of the Ebola Virus Disease (EVD). EVD, a highly communicable disease was discovered in the year 2013 in a small town called Guineada in Guinea. The disease quickly spread across the West African countries of Sierra Leone, Liberia and Cote D'Ivoire, due to the close trade relationships between the originating country and these countries<sup>8</sup>. The fatality rate of the disease is estimated to be about 90%, as once a person is infected with the virus it takes a few days before the patient dies, especially when treatment is unavailable<sup>9</sup>. The majority of the countries affected were from the West African region, hence our research focus area.

The occurrence of these types of disease greatly affect the life expectancy rate in an environment. Life expectancy is one variable that totally captures the gaps existing in the healthcare sectors, giving details on the maximum lifespan of healthy persons<sup>10</sup>. The effects of EVD outbreaks can be analyzed and used by the government of the population, policy makers, financial analysts, and public health organizations to set funds aside for such unforeseen diseases, so that when such diseases break out, immediate action can be taken.

The countries included in this study were Benin, Burkina Faso, Cote D'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Nigeria, Senegal, Sierra Leone, Togo, and São Tomé and Príncipe. Most of these countries have experienced civil wars, causing a high degree of resource scarcity, displacement, violence, domestic chaos, and poor healthcare systems. The governments are generally highly corrupt and deliberately make education inaccessible to the population, making illiteracy

levels high which eventually leads to inadequate human intellectual resources especially having qualified healthcare providers<sup>11</sup>. The education, training and skills acquired by healthcare providers are either outdated or not up to standard, leading to poor service delivery and high mortality rates. The World Bank reports show that although Africa has up to 24% of global diseases, available healthcare providers workforce is at a mere 3%<sup>11</sup>. An interesting turn of events has shown an upward slope in healthcare expenditure by the governments of West African populations for the past decade, although they are enhancing and investing in their economy, likewise their healthcare sectors, it is unfortunate the life expectancy figures remains low<sup>11</sup>.

It is therefore important to improve the facilities and infrastructure of healthcare centers with an increased number of beds, medications, staff (doctors, nurses, attendants and clerks) and skills training on a regular basis for the healthcare providers<sup>12,13</sup>. Financing the healthcare system should not be the only focus of government and policy makers, focus should also be on creating a universal healthcare service that is equally accessible to all, no matter their financial circumstances. Access to healthcare should be a human right, considering social and political factors to create and develop healthcare systems universally.

Life expectancy is low within populations that have low incomes, as many needs are not met due to low financial resources, hence the World Health Organization implore governments to intervene using strategic management to reduce the healthcare systems unmet needs<sup>15</sup>. This could be achieved by re-defining and re-strategizing the functions and roles of healthcare centers<sup>14</sup>. It is unfortunate that the increase in the number of people accessing the healthcare systems has not led to an improvement in income level for the population, causing over-crowding of the limited resources available<sup>16</sup>.

### **Research objective**

In this research, the issue of increasing healthcare spending against life expectancy variable was tackled, being that financial costs are concerns to

low income earners. The focus was on finding out if spending more and investing in healthcare results to better healthcare outcome of increased life expectancy, or on the contrary, causes inflation and higher cost of administrative management, like unnecessary spending on technology, ineffectiveness in comparatives or corruption by individuals or groups<sup>15</sup>.

Enhancing and improving the healthcare environment requires proper allocation of resources sufficient for the population therefore, achieving a healthy environment requires high quality spending or investment into the healthcare sector, be it private or public<sup>23</sup>. When life expectancy increases, there is a direct increase in life span in these populations. Healthcare expenditure should be increased in every aspect, financially or by improvement in quality of human resources used to service the healthcare sector<sup>16</sup>.

When a population and its environment experience increased life expectancy, it also experiences an increase in the standard of living due to an increase in the rate of investments and savings, this results in improved economic growth<sup>17</sup>. Studies, especially on developing countries, have shown that an increase in public healthcare expenditure plays a more important role in meeting the sustainable development goals<sup>10,19,20</sup>. Research has also shown that due to high levels of corruption in most developing countries especially in West Africa, governments do not commit to investing adequately in the healthcare sector or allocate adequate resources to increase healthcare expenditure<sup>18</sup>.

### **Methods**

The data used for this research ranged from the year 1999 to 2014, primarily from the World Bank indicators and supportive data from other credible sources such as reports on HDI, reviews and data from the WHO (World Health Organization), and UN (United Nations) for 15 West African countries. The design of the research provided comparative information on life expectancy rates across these nations. The populations were investigated in three groupings, as a whole (total), adult-female, and adult-male groupings.

**Table 1:** Variable Definitions

1	LEBF (YEARS)	life expectancy at birth female (years)
2	LEBM (YEARS)	life expectancy at birth male (years)
3	LEBT (YEARS)	life expectancy at birth total (years)
4	HEP	Health expenditure private
5	HEPP	Health expenditure public
6	HETOTAL	Health expenditure public-private
7	POPHE (%)	Private out-of-pocket health expenditure (% of private expenditure on health)
8	TOPHE (%)	Total out-of-pocket health expenditure (% of total expenditure on health)
9	APG (%)	Annual population growth (annual %)
10	FP (%)	Female population (% of total)
11	MP (%)	Male population (% of total)
12	TP (TOTAL)	Total population

Pooled regression and correlation methods (Pairwair) were used to ensure results that are reliable, valid and unbiased.

### Variables

The following variables were investigated to further measure the impact of healthcare expenditure on life expectancy: healthcare expenditure private (HEP), healthcare expenditure public (HEPP), healthcare expenditure total (HETOTAL), female-life expectancy at birth (FLEB), female-population (FP), male-life expectancy at birth (MLEB), male-population (MP), total population-life expectancy at birth (TLEB), annual-population growth (APG), private out-of-pocket expenditure (POPHE), and total out-of-pocket expenditure (TOPHE).

### Research formula

Research formula for independent variable healthcare expenditure and dependent variable life expectancy. The healthcare expenditure was run for private, public, and public-private sectors of the healthcare system, while the life expectancy was run for the population of females, males and both sexes.

$$Y_{it} = a_i + \beta_2 X_{2+} u_{it}, \quad (1)$$

Where

$i = 1 \dots n$  ( $n$  – the number of countries);

$t = 1 \dots T$  ( $T$  – the number of periods);

$Y$  = the value of dependent variable (Life expectancy for female, male and total) for country  $i$  in period  $t$ ;

$X_{it}$  = the vector of  $k$  regresses (Healthcare expenditure for private, public and total)

$d$  = the vector of  $k$  coefficients;

$u_{it}$  = error term for each observation distributed normally with '0' mean and constant variance.

### Hypothesis

H0: Increase in healthcare expenditure does not increase the life expectancy for private health sector

H1: Increase in healthcare expenditure increase the life expectancy for private health sector

Result: Null hypothesis here is accepted while H1 is rejected.

H0: Increase in healthcare expenditure does not increase the life expectancy for public health sector

H2: Increase in healthcare expenditure increase the life expectancy for public health sector

Result: Null hypothesis here is rejected while H2 is accepted.

H0: Increase in healthcare expenditure does not increase the life expectancy for public-private health sector

H3: Increase in healthcare expenditure increase the life expectancy for public-private health sector

Result: Null hypothesis here is rejected while H3 is accepted.

### Results

Table 2 summarizes the descriptive statistics of the variables used on the mean, standard deviation, minimum value and maximum value. Life expectancy at birth for female (LEBF) had the highest values of mean at 56.54, standard deviation at 5.98, minimum value at 38.79 and maximum value at 68.43 HEPP.

**Table 2:** Descriptive Statistics for healthcare expenditure in West Africa

S/NO	Variable	Observations	Mean	Std. Dev	Min	Max
1	LEBF	240	56.54	5.98	38.79	68.43
2	LEBM	240	54.55	5.37	36.87	64.51
3	LEBT	240	55.52	5.65	37.81	66.38
4	HETOTAL	240	5.90	2.39	2.43	14.39
5	HEP	240	3.68	2.07	1.23	11.05
6	HEPP	240	2.22	.96	.41	6.03

**Table 3:** Correlation Results

PAIRWISE CORRELATION		
	HEP	HEPP
LEBF	-0.3687	0.3944
LEBM	-0.3989	0.3823
LEBT	-0.3848	0.3899

**Table 4:** LEBF regression with HEP, HEPP and HETOTAL

LEBF	MODEL 1	MODEL 2	MODEL 3
	HEP	HEPP	HETOTAL
Cof	-1.22	2.78	2.45
Std. Err.	.15	.33	.37
Constant	54.86	54.86	51.08
Std. Err.	.92	.92	.89
F(2, 237)	59.17	59.17	F(1, 238) = 43.83
Prob > F	0.00	0.00	0.00
R-squared	0.33	0.33	0.15

**Table 5:** LEBM regression with HEP, HEPP and HETOTAL

LEBM	MODEL 1	MODEL 2	MODEL 3
	HEP	HEPP	HETOTAL
Cof	-1.17	2.45	2.13
Std. Err.	.13	.29	.33
Constant	53.43	53.43	49.81
Std. Err.	.82	.82	.81
F(2, 237)	63.47	63.47	F(1, 238) = 40.73
Prob > F	0.00	0.00	0.00
R-squared	0.34	0.34	4.98

**Table 6:** LEBT Regression with HEP HEPP and HETOTAL

LEBT	MODEL 1	MODEL 2	MODEL 3
	HEP	HEPP	HETOTAL
Cof	-1.19	2.61	2.29
Std. Err.	.14	.31	.35
Constant	54.13	54.13	50.43
Std. Err.	.87	.87	.84
F(2, 237)	61.85	61.85	F(1, 238) = 42.67
Prob > F	0.00	0.00	0.00
R-squared	0.34	0.34	0.15

Healthcare expenditure public had the lowest value for mean at 2.22, standard deviation at .96, minimum value at 0.41 and maximum value at 6.03 compared to the values of healthcare private and total.

The pairwise correlation method employed in Table 3 showed that healthcare expenditure public correlates positively with LEBF at 0.3944, LEBM at 0.3823 and with LEBT at 0.3899. On the other hand, private healthcare expenditure negatively correlates with the variables LEBF, LEBM and LEBT.

Table 4 shows HEP had a negative coefficient of -1.22, while the coefficient is positive for HEPP at 2.78 and HETOTAL at 2.45 for the regression for LEBF.

Regression shown in Table 5 for LEBM shows a negative coefficient value for HEP at -1.17, positive coefficient for HEPP and HETOTAL at 2.45 and 2.13 respectively.

Table 6 shows regression for LEBT which resulted in a negative coefficient value for HEP at -1.19 and positive coefficient value of 2.61 and 2.29 for HEPP and HETOTAL respectively.

Table 7 summarizes with random-effect regression for healthcare expenditure public for LEBM, LEBT and LEBF with coefficient values of 0.90, 0.94 and 0.97 respectively.

Table 8 summarizes the available resources of the selected countries, the life expectancy information at birth for the total population, male population, female population and both sexes.

## Discussion

We can compare percentage spending to other countries outside the West African region, such as 7.02% allocation of GDP government healthcare

**Table 7:** LEBM, LEPT, LEBF and random-effect regression with HEPP

HEPP	MODEL 1	MODEL 2	MODEL 3
	LEBM	LEBT	LEBF
Cof	.90	.94	.97
Std. Err.	.22	.22	.22
Inter (z)	4.07	4.20	4.33
P >  z	0.00	0.00	0.00
Rho	.78	.80	.81
R-squared		0.06	
Within	0.06	0.23	0.07
Between	0.23	0.15	0.24
Overall	0.14		0.15

expenditure in Lebanon, Oman at 2.75% of its GDP, Jordan at 8.04%, Pakistan at 2.19% all in the year 2010<sup>19</sup>, It is important to note that this plays out differently in public and private sectors of healthcare systems.

The pairwise correlation method employed in Table 3 showed that healthcare expenditure public correlates positively with LEBF at 0.3944, LEBM at 0.3823 and with LEPT at 0.3899. On the other hand, private healthcare expenditure negatively correlates with the variables LEBF, LEBM and LEPT. This shows more positive outcomes in increasing the healthcare expenditure at the public healthcare sector compared with the private sector.

The HEP had a negative coefficient of -1.22, while the coefficient was positive for HEPP at 2.78 and HETOTAL at 2.45 for the regression for LEBF as shown in table 4. This indicates that life expectancy for the female population will not increase for the private sector, but will certainly increase for the public and public-private sector when healthcare expenditure is increased.

Regression shown in Table 5 for LEBM showed a negative coefficient value for HEP at -1.17, positive coefficient for HEPP and HETOTAL at 2.45 and 2.13 respectively. This indicates that life expectancy for the male population will not increase for the private sector, that is why the value for this variable returned negative, but its sure to increase for the public and public-private sector when healthcare expenditure is increased, hence the positive values for these variables.

When the whole population is studied together, regardless of the gender as shown in table 6: regression for LEPT which resulted in a

negative coefficient value for HEP at -1.19 and positive coefficient value of 2.61 and 2.29 for HEPP and HETOTAL respectively. This also indicates that investment should be focused on the public and public-private sector, because their values returned positive, signifying increased in life expectancy as the healthcare expenditure increases, rather than the private sector with a negative value indicating no increase in life expectancy, even when healthcare expenditure increases.

Table 7 summarizes with random-effect regression for healthcare expenditure public for LEBM, LEPT and LEBF with coefficient values of 0.90, 0.94 and 0.97 respectively. This shows a significant relationship exist between all the variables and the public sector. By all measures, the policy makers and the government can have the right focus on budgeting and resources allocation within their population health sectors with the recommendation of these results.

Table 8 shows that the number of physicians in West Africa is limited. The number of physicians per 10,000 persons ranges of less than 1 to not greater than 5 number. This is very poor and unhealthy for the population; hence it results in low life expectancy compared to developed nations like the USA and the UK with an average of 85 years life expectancy<sup>20</sup>.

The number of nurses is higher than that of physicians for all the investigated countries, but compared with the population density, it is ineffective hence the government need to invest more in the education of the population towards having more professional healthcare providers to service the fast-growing population of these countries.

Women generally live longer than men by an average of 4.6 years<sup>20</sup>. The life expectancy of populations is affected by the resources available in the healthcare systems, such as human resources (number of physicians and nurses), healthcare equipment and facilities, which can be made available when healthcare expenditure is increased.

It is very important for the governments of the investigated countries to increase healthcare expenditure to improve their population's healthcare system. This research has helped to

**TABLE 8:** Number of Physicians and Nurses with Life Expectancy Summary for West Africa

COUNTRY	PHYSICIANS (2000-2007)		NURSES (2000-2007)		LIFE EXPECTANCY AT BIRTH (YEARS)			
	NUMBER	DENSITY (PER 10,000 POPULATION)	NUMBER	DENSITY (PER 10,000 POPULATION)	TOTAL POP.	MALE	FEMALE	BOTH SEXES
Benin	311	<1	5,789	8	10,880	58.8	61.1	60.0
Burkina Faso	708	1	6,557	5	18,106	59.1	60.5	59.9
Cote D'Ivoire	2,081	1	10,180	6	22,702	52.3	54.4	53.3
Gambia	156	1	1,881	13	1,991	59.8	62.5	61.1
Ghana	3,240	2	19,707	9	27,410	61.0	63.9	62.4
Guinea	987	1	4,408	5	12,609	58.2	59.8	59.0
Guinea Bissau	188	1	1,072	7	1,844	57.2	60.5	58.9
Liberia	103	<1	1,035	3	4,503	59.8	62.9	61.4
Mali	1,053	1	8,338	6	17,600	58.2	58.3	58.2
Mauritania	313	1	1,893	6	4,068	61.6	64.6	63.1
Nigeria	34,923	3	210,306	17	182,202	53.4	55.6	54.5
Senegal	594	1	3,287	3	15,129	64.6	68.6	66.7
Sierra-Leone	162	<1	2,510	5	6,453	49.3	50.8	50.1
Togo	225	<1	1,937	4	7,305	58.6	61.1	59.9
São Tomé	81	5	308	19	190	65.6	69.4	67.5

Source: World Health Statistics 2016  
World Health Statistics 2009

direct attention to this crisis which will hopefully result in funding for the public healthcare sector. Results show a positive relationship between the investigated variables of healthcare expenditure versus life expectancy, unlike the other sectors of private and public-private partnership which resulted in a negative relationship between the variables of healthcare expenditure being increased but life expectancy had no positive improvement. Unfortunately, when funds are increased for the private and public-private sector, the administration focuses on increasing salaries of staff rather than improving the healthcare system<sup>19</sup>. Therefore, healthcare services remain expensive and inaccessible to most of the population who are low income earners. We conclude that the public healthcare sector should be the major focus of increase for healthcare expenditure.

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## Contribution of Authors

Design of study, data collection, and data analysis EYS and MB. Manuscript preparation, EYS

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