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THE NEXUS BETWEEN COSTS AND BENEFITS OF MEDICAL ATTENTION AMONG AFRICAN COUNTRIES

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Abstract

COVID-19 has exposed the lapses in the healthcare systems of many countries. The pandemic had shown that there are deficiencies in the world health system. Despite the fact that healthcare decisions are taken daily, the healthcare system still finds it difficult to harness spending by households, governments and donor agencies for improved health outcomes. This study examined the nexus between costs and benefits of medical attention in some selected African countries. The data employed was extracted from World Development Indicators using out-of-pocket expenditures (OPHE), domestic government expenditures (DGHE) and domestic private health expenditure (DPHE) and external health expenditures (EXHE) as independent variables and female life expectancy (FLE), male life expectancy (MLE) and infant mortality rate (IMR) as dependent variable. Static panel data analysis was employed. The study found that while OPHE exerted undesirable effects on health outcomes, DPHE and DGHE improved Male and Female life expectancies and reduced the infant mortality rate. However, EXHE failed to

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influence health outcomes. The study concluded that healthcare expenditures have significant positive influence on health outcome provided it is efficiently spent and effectively coordinated. The study recommended a coordinated approach whereby public, private and donor agencies come as strategic partners for improved health outcomes.
Keywords: Medical attention, Healthcare expenditure, Mortality rate, Life Expectancy

INTRODUCTION

Decisions concerning the best or most efficient amount of medical care to provide are made daily in the health care sectors around the world. Achieving better health in the form of better nutrition, fewer illness period, fewer days lost due to ill health, improved productivity of labour force, high life expectancy and low infant mortality are the expectations of every individual (Dercon & Ruttens, 1998). Similarly, harnessing healthcare expenditure from government, private individuals and donor agencies, for improved health has been difficult, particularly in Africa. Sometimes, in the decision-making process, questions such as, at what point does the added cost of providing medical care outweigh the benefits in terms of improved health and how to harness resources from government and other sources is yet unanswered. The recent global outbreak of Corona Virus disease popularly known as COVID-19 has brought to the limelight the lapses in the health systems across the globe. The deadly disease which cut across the whole world had practically shown that there are deficiencies in the world health system. The disease and its pandemic nature have underscored the need for health policy makers to seek answers to these questions. Practically, answers to these questions are complex because costs and benefits depend on factors such as the availability of medical resources, patient preferences, the severity of illness among others.

Edeme, Emecheta and Omeje (2017) opined that medical care is very important as it is one of the major strategies of reducing infant mortality. Similarly, Dercon and Ruttens (1998) discoursed that the level, quality and coverage of health care in Africa is very insufficient as the continent health system is one of the poorly financed in the world. Previous empirical studies revealed that provisions for medical care incorporated in developing countries' budget are far below expectation, while the populace have to struggle for the limited infrastructure (Edeme, Emecheta & Omeje, 2017; Lorenz, 2012; Munge & Briggs, 2014; World Bank 2015). Also, payment for medical attention is financed majorly from individuals' out-of-pocket which indicates an unfair distribution of resources (Rezapour, Arabloo, Tofighi, Alipour, Sepandy, Mokhtari & Ghanbary, 2016; Rezapour, Larijani, Azar, & Sofla, 2012; Sreeramareddy, Sathyanarayana, & Kumar, 2012).

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Studies also showed that high out-of-pocket spending on medical care can make the sick, their families and sometimes their extended family members go into poverty (Okumura & Ito, 2013; Xu, Evans, Kawabata, Zeramdini, Klavus, & Murray, 2003). These, therefore, are some of the contributors to the increased healthcare problems leading to low life expectancy and high mortality rate in Africa (Edeme, et al., 2017). World Bank data (1994, 2015) revealed that 43% of all expenditures on health, comes from private out-of-pocket expenditures, 37% from government and about 20% from donor agencies in Africa. In Guinea, for example, 91% of all health services are out-of-pocket; in the Democratic Republic of Congo (DRC) it accounted for over 80%, while countries like South Africa and Botswana, out-of-pocket payments are only 10% and 12%, respectively (National Health Accounts Database, The World Bank Data, 2003). On average, governments in Africa pay for about one third of total health expenditures, leaving a gap of about 65% of healthcare expenditures to private individuals and donor agencies (National Health Accounts Database, The World Bank, 2003).

In absolute term, the amount spent by governments on healthcare vary dramatically among countries, with one of the richest countries, South Africa, spending almost 86 times more per person (US$258) than the Democratic Republic of Congo - DRC (US$3), which is one of the poorest countries (National Health Accounts Database, The World Bank Data , 2003). By contrast, the relative difference in public spending between South Africa and the United Kingdom (US$1,835) is approximately seven times (National Health Accounts Database, World Bank Data, 2003). This broad disparity implies that affordable solutions for improving healthcare systems for countries like South Africa and Botswana are likely to be out of reach for countries like Burundi and Ethiopia. When both public and private spending on health are harnessed in a coordinated and efficient manner, more money is likely to be available for spending on healthcare service delivery for improved health outcomes in Africa.

World Health Organisation, WHO, (2010), stated that if progress is to be achieved in the effort made towards universal health coverage delivery, government funding should be increased and reliance on out-of-pocket payments (OOP) and private health insurance should be reduced as neither means of financing contribute equitably to the progress of universal health care. The report stated further that when direct payment falls within 15-20% of the amount spent on total health expenditure that the level of impoverishment and catastrophe falls to a negligible limit (WHO, 2010).

Sachs (2001), reporting the Macroeconomic Commission on Health observed that it costs average of US$34 per person per annum to provide an essential package of health services, which includes basic prevention and treatment for HIV/AIDS, TB, malaria, the common childhood illnesses and maternity services, which increases to US$40 after taking care of

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inflation. Sekhri & Savedoff, (2005) therefore asserted that taking into account total health spending (public and private funds and external assistance), in principle, 36 countries out of the 48 counties in Sub-Sahara Africa could pay for this essential package, while 12 countries could not. Xu, et al., (2003) discovered that a percent increase in out-of-pocket expenditure leads to an average increase in the level of households going through catastrophic payment by 2.2%; that is there is a strong relationship between government expenditure on health as a percentage of GDP and the proportion of health care expenditure financed from out-of-pocket. The task force on innovative financing for health systems estimated that, for low-income region, a total of US$54 per capital will be required by 2015 to achieve the Millennium Health Development Goals as out-of-pocket spending on health care cost was estimated at 40% of total current health spending in 2015 (Piatti-Funfkirchen, Lindelow & Yoo, 2018). Andrews, Avitabile and Gatti (2019) in their study observed that high-income regions spend more on health than any other regions, as the low-income countries have a current health spending of 1.5% of GDP.

In some part of Africa, the major accessible medical care is herbal products which have been in existence for several generations before the presence of the Europeans in the region and the subsequent introduction of biomedical approach to health (UNAIDS, 2002). While acknowledging that western biomedicine introduced major technological advancements and innovations that changed the health care system and survival prospects of the people of the region, UNAIDS (2006), admitted that these advances have continued to be available to the privileged minority. It recognised that a great number of Africans continue to use herbs and other alternative herbal therapy as their main source of medical care.

Seeking medical care can have exceptionally great effects on people, apart from time and money that may be expended in preventing and treating illnesses, the inability of workforce to improve productivity can also result from absence of medical attention with the attendant great detrimental effect on household production and gross domestic product. Majority of the African countries experience high prevention costs, high treatment costs, loss of labour, alteration in social and economic behaviour which have serious effects on economic growth and development (Okorosobo, Okorosobo, Nwabu, Orem & Kirigi, 2011). According to Edeme, et al., (2017), a country seeking economic development should ensure that it spent fairly on medical care. Research on early childhood development showed that access to quality prenatal and postnatal care not only decreases mortality but also improves subsequent school performance, which is critical to future labour productivity (Van der Gaag, 2000). Given this background, the present study conducts a cost and benefit analysis of medical care in some selected countries in Africa, using parameters such as Male Life Expectancy (MLE), Female Life Expectancy (FLE), Mortality Rate of under-five (MR) as health outcomes and Out-of-Pocket Expenditure

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(OPHE), Domestic Government Expenditure (DGHE), Domestic Private Health Expenditure (DPHE) and External Health Expenditures (EXHE) as health care spending.

LITERATURE REVIEW

Substantial research attention and efforts have been devoted to the impacts that health expenditure have on health outcomes. Novignon, Olakojo and Nonvignon (2012) investigated the effect of public and private healthcare expenditure on health status in 44 countries in the Sub-Saharan Africa. Health status was proxied using life expectancy at birth (years) and death rate (per 1000) people. The study observed a negative effect of healthcare expenditure on life expectancy. However, in view of the fact that life expectancy varies based on gender, Berin, Stolnitz and Tenenbein (1989), observed that analysis of effect of health expenditure based on male and female life expectancies could provide a useful insight for a more informed policy formulation and decision. Similarly, Deshpande, Kumar and Ramaswami (2014) adopted cross-sectional data from 181 countries cutting across different continents around the world to analyse the effect of National healthcare expenditure on life expectancy. However, the study ignored possible differences in socio-economic and demographic variables which impact on health outcomes.

Sghari and Hammami (2016) studied the relationship between life expectancy and health spending among the OECD countries and observed no plausible causal link between health spending and life expectancy. Matthew, Adegboye and Fashina (2015) found that the present and past government spending on healthcare service delivery in Nigeria significantly affect health outcomes, but there is however a negative relationship between government health spending and health outcome proxy by life expectancy. The study of Akinkugbe and Afeikhena (2006), on the other hand, in Sub-Sahara Africa, Middle East and North Africa found a positive and significant effect of health expenditure as a ratio of GDP on infant mortality and life expectancy. Using panel data analysis in the estimation of life expectancy as a function of health expenditure, Kim and Lane (2013) found a positive relationship between government health expenditure and life expectancy at birth. Similarly, Jaba, Balan and Robu (2014) observed a significant relationship between health expenditures and life expectancy.

The inconsistencies in previous research findings, possibly attributable to differences in measurement of health outcomes and contextual differences of the countries investigated has therefore necessitated this study. This study, therefore, hypothesized as follows:

$H_0$1: Healthcare expenditure does not have significant influence on male life expectancy

$H_0$2: Healthcare expenditure does not have significant influence on female life expectancy.

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Filmer and Pretchett (1999) observed that there are other factors apart from healthcare expenditure that significantly determine health outcomes. The study established an inversed relationship between health expenditure and infant mortality rate. Issa and Quattara (2005) in their study found out that a significant inverse relationship exists between health expenditure and infant mortality. Kim and Lane (2013) in their comparative study of Government health expenditure and public health outcomes among OECD countries, found a statistically significant association between government health expenditure and public health outcomes. Particularly, the study revealed a negative relationship between government health expenditure and infant mortality rate. Rahman, Khanam and Rahman (2018) observed that the effect of both private and public health expenditures on infant mortality were negative and significant. Shetty and Shetty (2014) observed that countries that spend a reasonable proportion of their annual budgetary income on healthcare expenditure get a relatively lower infant mortality rate than countries that do not. The studies of Arthur and Oaikhenan (2017) and Novignon and Lawanson, (2017) showed a positive effect of expenditures on health and infant mortality, whereas, Kiross, Chojenta, Barker and Laxton, (2020) study revealed that public health expenditure and external health expenditure displayed a significant negative relationship with infant mortality while private health care spending showed no significant association with infant mortality**.** Other studies that paid particular attention to health expenditure, mortality rate, life expectancy at birth include Cutler, Deaton and Lleras-Muney (2006); Porcas and Soukiazis (2010); Anyanwu and Erhijakpor (2009); Barenberg, Basu and Soylu (2015). Findings from these studies revealed that the link between expenditure on health care services and infant mortality rate is still opaque. Hence, we further hypothesised that:

$H_0$3: Healthcare expenditure does not have significant impact on infant mortality rate

THEORETICAL CONSIDERATION

This study adopted the Human capital theory as postulated by Schultz (1961). The theory is predicated on the notion that at the level of the individual, health is regarded as a commodity which the individual will wish to consume and maximize subject to his/her budget constraint, given a number of internal and external factors which have impact on individual's health. In this instance, health is a commodity produced using various inputs emanating from various expenditure on delivery of healthcare services. Applying production function, Thorton and Rice (2008), analysed health status whereby health is an output of a healthcare system, which is produced through inputs to that system. In this case, expenditure on health care delivery that proxy medical care, constitute health inputs, whose outputs from the health system are the resultant health outcomes measured through life expectancy and childhood mortality. The theory

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predicts that a marginal increase in health expenditure should have a direct impact on the health outcomes measured by life expectancy, infant mortality rate and other health outputs.

RESEARCH METHODS

Research Design

This study adopted a descriptive research design.

Data set

The data set utilised were Out-of-Pocket Expenses (OPHE), Domestic Government Expenditure (DGHE), Domestic Private Health Expenditure (DPHE) and External Health Expenditure (EXHE) as independent variables to proxy the direct cost of medical attention – all measured in US dollar. Out of pocket payments are spending on health directly out of pocket by households in each country. In this study, the Out-of-Pocket Expenditure (OPHE) are health expenditure through out-of-pocket payments per capital in US dollar. Current private expenditures on health per capita expressed in current US dollars is the Domestic Private Expenditure (DPHE) sources include funds from households, corporations and non-profit organizations. Such expenditures can be either prepaid to voluntary health insurance or paid directly to healthcare providers. Public expenditure on health from domestic sources per capita (DGHE) expressed in current US dollars. Current external expenditures on health (EXHE) per capita expressed in current US dollars. External sources are composed of direct foreign transfers and foreign transfers distributed by government encompassing all financial inflows into the national health system from outside the country. The moderating variable employed in this study were natural logarithm of Gross Domestic Product per capital (lnGDPPC) and natural logarithm of Total Population (lnTPPL).

Male Life Expectancy (MLE), Female Life Expectancy (FLE) and Infant Mortality Rate (IMR) as dependent variables to proxy the direct benefits of medical attention. The MLE and FLE are life expectancies at birth indicates the number of years a new-born infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout his/her life. The infant mortality is the under-five mortality rate, that is, the probability per 1,000 that a new born baby will die before reaching age five, if subject to age-specific mortality rates of the specified year.

Sample size and sampling technique

Forty-one countries were purposively selected based on availability of study variables for the period under consideration. The cut-off years of 2000 and 2017 were considered relevant

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due to availability of data to proxy the research variables and to evaluate investment in healthcare as required by the millennium development goals (MDGs) that metamorphosed to sustainable development goals (SDGs). Countries excluded based on non-availability of relevant data for the years under consideration include Cameroon, Djibouti, Egypt, Eritrea, Lesotho, Libya, Sao Tome and Principe, Somalia, Sudan, South Sudan, Zimbabwe.

Model specification

$MLE_{it} = \beta_0 + \beta_1 OPHE_{it} + \beta_2 DGHE_{it} + \beta_3 DPHE_{it} + \beta_4 EXHE_{it} + \beta_5 lnGDPCC_{it} + \beta_6 lnTPPL_{it} + \varepsilon_{it}$ (1)

$FLE_{it} = \beta_0 + \beta_1 OPHE_{it} + \beta_2 DGHE_{it} + \beta_3 DPHE_{it} + \beta_4 EXHE_{it} + \beta_5 lnGDPCC_{it} + \beta_6 lnTPPL_{it} + \varepsilon_{it}$ (2)

$IMR_{it} = \beta_0 + \beta_1 OPHE_{it} + \beta_2 DGHE_{it} + \beta_3 DPHE_{it} + \beta_4 EXHE_{it} + \beta_5 lnGDPCC_{it} + \beta_6 lnTPPL_{it} + \varepsilon_{it}$ (3)

Where:

MLE_{it} = Life expectancy at birth, Male (years)

FLE_{it} = Life expectancy at birth, Female (years)

IMR_{it} = Mortality rate of under 5 years per 1,000 live births each year

$OPHE_{it}$ = Out-of-Pocket expenditure US$

$DGHE_{it}$ = Domestic government expenditure on health per capital of a given country in US$

$DPHE_{it}$ = Domestic private expenditure on health per capital of a given country in US$

$EXHE_{it}$ = External health expenditure on health per capital of a given country in US$

lnGDPCC = Natural logarithm of gross domestic product per capital in US$

lnTPPL = Natural logarithm of total population of each country for each year

ε_{it} = error term.

Method of data analysis

This study employed a combination of descriptive and inferential statistics for the purpose of drawing conclusions and recommendations. The summary statistics employed with a view to gaining understanding of the statistical properties of the data set include mean, standard deviation, minimum and maximum. Pearson's product moments coefficient of correlation and Variance inflation Factor (VIF) test were employed as preliminary techniques for gaining insight into the possible multicollinearity among the explanatory variables Static panel data econometric analysis was employed using three different estimators viz: pooled linear regression, fixed effect and random effect (GLS). Appropriate models were selected based on the inherent statistical properties of the data set.

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RESULTS

Descriptive Statistics

The descriptive statistics of the variables of interest is presented in Table 1. The average male life expectancy (MLE), female life expectancy (FLE) and infant mortality rate (IMR) for the sampled countries during the period covered by the study were 56.28 years, 59.69 years and 95.70 deaths for children under 5 years per 1,000 live births. These statistics indicated that on average, female in the sampled countries tend to live, at least about 3 years longer than their male counterparts.

Similarly, mortality rate of children under the age of 5 years is approximately 96 per 1,000 live births each year. This implied that on average about 96 children, out of 1,000 live births, died before attaining the age of five years indicating a slightly lower than 10% infant mortality rate. The average domestic private health expenditure (DPHE), domestic government health expenditure (DGHE), external health expenditure (EXHE) and out-of-pocket health expenditure (OPHE) per capital for the selected countries were US$44.63, US$40.71, US$9.95 and US$31.22 respectively during the period covered by the study. This implied that on the average, domestic private donors tend to spend more on healthcare, by way of corporate social responsibility, than government by about US$3.92 among the sampled countries. Also, the contribution of out-of-pocket expenditure and external health expenditure of US$31.22 and US$9.95 respectively implied that approximately 25% and 8% of the average total healthcare spending were contributed by households and funding by international donor agencies.

In terms of the dispersion of the data set, the minimum DPHE, DGHE, EXHE and OPHE were US$1.58, US$0.16, US$0.03 and US$1.43, while the maximum values were US$337.77, US$352.52, US$106.76 and US$319.1 with standard deviation of US$58.26, US$63.85, US$13.87 and US$43.04 respectively. These indicate that DPHE, DGHE and OPHE varied widely among the sampled countries over time. This can be attributable to significant differences in income level of the household measured in per capital GDP (GDPPC) of the sampled countries. This is confirmed by the degree of dispersion of each of the observations from the mean value of US$22.84 and standard deviation of US$16.90. Similarly, the proxies for various health outcomes DGE exhibited significant variations with MLE, FLE and IMR exhibiting standard deviation of 7.54 years, 7.98 year and 45.30 deaths per 1000 live birth of children under the age of 5 years in the sampled countries.

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Table 1: Descriptive Statistics

VARIABLES	Obs.	Mean	Std. Dev.	Min	Max
MLE	738	56.28	7.54	38.86	75.31
FLE	738	59.69	7.98	40.01	78.35
IMR	738	95.70	45.30	14.30	234.00
DPHE	738	44.63	58.26	1.58	337.77
DGHE	738	40.71	63.85	.18	352.52
EXHE	738	9.95	13.87	.03	106.76
OPHE	738	31.22	43.04	1.43	319.15
GDPPC	738	2021.53	2875.39	111.93	22942.58
LnGDPPC	738	6.95	1.17	4.72	10.04
LnTPPL	738	15,96	1.40	12.97	19.07

Table 2: Variance Inflation Factor

VARIABLES	VIF	1/VIF
DPHE	7.38	.1355
OPHE	4.67	.2141
DGHE	4.22	.2371
LnGDPPC	3.58	.2794
EXHE	1.33	.7528
LnTPPL	1.17	.8546
Mean VIF	3.72	

Table 3: Correlation Matrix of Dependent and Independent Variables

VARIABLES	MLE	FLE	IMR	DPHE	DGHE	EXHE	lnGDPPC	OPHE	lnTPPL
MLE	1.000								
FLE	.9817	1.000							
IMR	-.8307	-.8766	1.000						
DPHE	.2813	.3239	-.4205	1.000					
DGHE	.3624	.4310	-.5473	.7799	1.000				
EXHE	-.1596	-.1013	-.1876	.1963	.3171	1.000			
LnGDPPC	.4599	.5038	-.6121	.7816	.7561	.2430	1.000		
OPHE	.3926	.3961	-.3452	.8002	.4553	-.0607	.6744	1.000	
LnTPPL	-.0254	-.0720	.0962	-.2426	-.2061	-.2156	-.2941	-.2756	1.000

The correlation matrix presented in Table 3 revealed that the natural logarithm of the gross domestic products (lnGDP) exhibited high positive correlation with DPHE and DGHE with the respective correlation coefficient of .7816 and .7561. Similarly, OPHE also exhibited high positive correlation with DPHE with correlation coefficient of .8002. The observed positive association among these variables is not unexpected as the economic prosperity of a country, measured by her GDP, is closely linked to the pattern of spending by households and private firms. However, the mean VIF of the explanatory variables of 3.72 presented in Table 2 indicates that inclusion of these variables in the same model is not harmful. The study's reported variance inflation factor of less than 4 indicated that there was no existence of multicollinearity among the regressors (Neter, Kutner, Nathtsheim & Wasserman, 1996).

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In addition, the observed negative association between infant mortality rate (IMR) on one hand and DPHE, DGHE, EXHE and OPHE on the other hand with coefficient of -.4205, -.5473, -.1876 and -.3452 respectively, indicated that the higher the level of expenditure on the provision of healthcare services, the lower the mortality rate. So also, the association between the IMR and lnGDPPC. However, population changes, measured by lnTPPL has a positive association with infant mortality rate with r = .0962. Of the health expenditure spending, the external health expenditure (EXHE) has negative association with male and female life expectancies. This association is unexpected and inconsistent with the study's *a-priori* expectation, as healthcare spending is expected to have positive association with male and female life expectancies as predicted by human capital theory.

INFERENTIAL STATISTICS

Test of Hypothesis one: $H_0$1: Healthcare expenditure/cost of medical attention does not have significant influence on male life expectancy

The study employed Hausman's specification test to determine the presence of either fixed or random effects. The Hausman's specification test's chi^2 statistic and the associated probability values of 552.44 and .0000 respectively revealed that fixed effect is preferred. The fixed effect chi^2 statistic of 213.42 and the p-value of .0000 further confirmed that fixed effect is statistically significant. The modified Wald test for heteroskedasticity in fixed effect with test statistic of 5.9e+05 and p value of .0000 implied that the null hypothesis of no heteroskedasticity can be rejected. Also, the Wooldridge test for first order serial correlation revealed that the null hypothesis that there is no first order autocorrelation can be rejected (F =22857.82, p = .0000). These were accounted for by estimating the parameter coefficients with Driscoll-Kraay robust standard error, the result of which is presented in Table 4.

The results revealed that out-of-pocket expenditure (OPHE) on health exerted a negative and statistically significant effect on male life expectancy (MLE) at 1% level of significance. The negative coefficient of -.0489 indicated that US$1 increase in annual OPHE per capital tend to reduce male life expectancy by approximately 18 days i.e. (.0489*365) among the sampled countries. Conversely, DGHE and DPHE exerted positive and statistically significant effect on male life expectancy (MLE) with the coefficients of .0131 and .0217 respectively. The respective p<.05. This implied that DGHE and DPHE positively influenced MLE of the sampled countries during the period of study. The coefficients of .0131 and .0217 implied that US$1 additional DGHE and DPHE investments per capital per annum in healthcare engendered about 5 days and 8 days improvements in male life expectancy respectively.

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However, external health expenditure (EXHE) did not exert significant influence on male life expectancy.

The moderating effect of the countries' wealth measured by the natural logarithm of GDP per capital (lnGDPPC) exerted significant positive effect on MLE (β = 1.0961, p<.01). This means that 1% change in GDP increases male life expectancy by more than one year. Similarly, 1% change in increase in population increases life expectancy of the sampled countries by about 18 years. The F-statistic of 9238.86and the associated p-value of 0.000 implied that the combined effect of OPHE, DGHE, DPHE and EXHE is statistically significant at 1%. The R^2 of .7999 also indicated that 79.99% of the changes in the mean male life expectancy is attributable to variables included in our model, while the 20.01% of the mean changes in male life expectancy among the sampled countries were caused by other factors not included in the model.

Decision: Based on the above interpretations, we are not expected to accept the null hypothesis one, that cost of medical attention does not have statistically significant effect on male life expectancy. We therefore accepted the alternative hypothesis and concluded that cost of medical attention has significant effect of male life expectancy of the selected African countries.

Table 4: Healthcare expenditure/ cost of medical attention and male life expectancy nexus for the selected African countries using static panel data estimators

VARIABLES	(1) OLS	(2) FE	(3) GLS	(4) Driscoll-Kraay
OPHE	.0986***	-.0616***	-.0433***	-.0489***
	(.0108)	(.0080)	(.0088)	(.0086)
DGHE	.0640***	.0131***	.0122***	.0131**
	(.0069)	(.0032)	(.0041)	(.0061)
DPHE	-.1102***	.0218***	.0118	.0217**
	(.0101)	(.0066)	(.0083)	(.0093)
EXHE	-.1129***	.0253***	.0172**	.0253*
	(.0179)	(.0080)	(.0101)	(.0135)
LnGDPPC	2.8362***	1.0961***	4.6510***	1.0961***
	(.3655)	(.2842)	(.2758)	(.2573)
LnTPPL	.6098***	19.3810***	7.0912***	19.381***
	(.1662)	(.7406)	(.5284)	(.5380)
Constant	27.2078***	-260.8922***	-89.1110***	-260.8922
	(3.3988)	(10.4506)	(7.7317)	(7.3069)
Observations	738	738	738	738
Adj. R^2	.3964	.7999	.7226	.7999
country effect	NO	YES	YES	YES
period effect	NO	NO	NO	NO
F-test	81.69	460.28		9238.86
Prob > F	.0000	.0000		.0000
Number of countryid	41	41	41	41

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F-test(u_i=0)	213.42	
Prob > F(u_i=0)	.0000	
Wald chi^2		1439.22
Prob > chi^2		.0000
Hausman's chi^2	552.44	
Prob > chi^2	.0000	
Modified Wald Test	5.9e+05	
	.0000	
Wooldridge Test	22857.82	
	.0000	

Table 4…

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Test of Hypothesis two: $H_0$2: Healthcare expenditure/cost of medical attention does not have significant influence on female life expectancy

With respect to the test of hypothesis two, the results of Hausman's specification test's chi-square statistic and the associated probability values of 474.55 and .000 respectively revealed that fixed effect is preferred. The F-test (u_i=0) and Prob > F (u_i=0) of 175.47 and .000 respectively confirmed that fixed effect is statistically significant, hence interpretations based on fixed effect estimation is valid. The modified Wald test for heteroskedasticity in the fixed effect model with chi-squared statistics and associated p-value of 36742.44 and .000 respectively indicated the rejection of null hypothesis of no heteroskedasticity. Also, the Wooldridge test for first order serial correlation revealed that the null hypothesis that there is no first order autocorrelation can be rejected (F = 20595.98, p =.000). The Driscoll-Kraay fixed effect estimates with robust standard error is therefore valid for interpretation. The results of these estimates are presented in Table 5.

The results presented in Table 5 revealed that while out OPHE exerted significant negative influence on female life expectancy (FLE), DPHE positively influenced FLE. The parameter coefficients of -.0616 and .0295 for OPHE and DPHE with their respective p<0.01 and p<.05 indicated that both OPHE and DPHE have significant influence on FLE. However, DGHE and EXHE did not exact significant influence on FLE. The OPHE negative coefficient of -.0616 implied that US$1 incremental investment in OPHE per capital exerted engendered about 22 days reduction in FLE and vice versa. The DPHE β of .0295 indicated that US$1 incremental investment in DPHE per capital brought about approximately 11 days increase in FLE. Like the MLE, FLE tend to improve with increase in population and GDP per capital with respective β = 20.5113 and 1.1255 and p< 0.01.

The F-Stat. of 2075.79 and the associated p-value of .000 revealed that the combined effect of all health expenditure moderated by GDP and population growth significantly influenced FLE at 1%. The Adjusted R^2 of .7713 also indicated that 77.13% of the changes in

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the mean value of female life expectancy is attributable to variables included in our model, while the 22.87% of the changes in female life expectancy among the sampled countries were due to other factors not included in the model.

Decision: Based on the above interpretations, we are not expected to accept the null hypothesis two that cost of medical attention does not have statistically significant effect on female life expectancy. We therefore accepted the alternative hypothesis and concluded that cost of medical attention has significant effect of female life expectancy of the selected African countries.

Table 5: Healthcare expenditure/ cost of medical attention and female life expectancy nexus for the selected African countries using static panel data estimators

VARIABLES	(1) OLS	(2) FE	(3) GLS	(4) Driscoll-Kray
OPHE	.0949***	-.0616***	-.0545***	-.0616***
	(.0113)	(.0070)	(.0099)	(.0117)
DGHE	.0750***	.0133***	.0126***	.0133*
	(.0072)	(.0037)	(.0046)	(.0061)
DPHE	-.1129***	.0295***	.0176*	.0295**
	(.0105)	(.0076)	(.0093)	(.1171)
EXHE	-.1055***	.0216**	.0123	.0216
	(.0187)	(.0092)	(.0114)	(.0173)
LnGDPPC	2.9726***	1.1255***	5.1736***	1.1255***
	(.3917)	(.3246)	(.3043)	(.2466)
LnTPPL	.4290**	20.5113***	6.5181***	20.5113***
	(.1735)	(.8461)	(.5584)	(.5609)
Constant	32.2706***	-275.6485***	-79.9955***	-275.6485***
	(3.8626)	(11.9392)	(8.1952)	(8.2983)
Observations	738	738	738	738
Adj. R^2	.4124	.7713	.6829	.7713
country effect	NO	YES	YES	YES
period effect	NO	NO	NO	NO
F-test	87.20	388.38		2075.79
Prob > F	.0000	.0000		.0000
Number of countryid	41	41	41	41
F-test(u_i=0)		175.47		
Prob > F(u_i=0)		.0000		
Wald chi^2			1222.14	
Prob > chi^2			.0000	
Hausman's chi^2		474.55		
Prob > chi^2		.0000		
Modified Wald Test		36742.44		
		.0000		
Wooldridge Test		20595.98		
		.0000		

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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Test of Hypothesis three: $H_0$3: Healthcare expenditure/cost of medical attention does not have significant influence on female life expectancy

With respect to hypothesis three, the results of Hausman's specification test presented in Table 6 revealed that the chi-square statistic and the associated p-values are 1146.84 and .0000 respectively, indicating that fixed effect model is preferred. The F-test (u_i=0) and Prob > F(u_i=0) of 223.92 and .0000 respectively established the statistical significance of the presence of fixed effect, hence interpretations on fixed effect estimation is valid. The modified Wald test for heteroskedasticity in the fixed effect model with chi-squared statistics and associated p-value of 93680.21 and .0000 respectively indicated that the null hypothesis of heteroskedasticity can be rejected. Also, the Wooldridge test of first order autocorrelation revealed that the null hypothesis that there is no first order autocorrelation can be rejected (F = 769.13, p =.0000). Therefore, parameter coefficients of fixed effect using Driscoll-Kraay robust standard error is valid for interpretation. The results of these estimates are presented in Table 6. The results presented in Table 6 showed that OPHE and DGHE exerted significant positive influence on infant mortality rate (IMR). The parameter coefficients of .1981 and .01712 for OPHE and DGHE with their respective p-value = .0000 indicated that both OPHE and DGHE have significant positive influence on IMR. However, the effect of OPHE on IMR is stronger in magnitude than DGHE. This implied that US$1 incremental investment in OPHE exerted greater detrimental influence on mortality rate. The parameter coefficients of .1981 and .01712 for OPHE and DGHE implied that US$1 incremental investment per annum per capital increase IMR by approximately 20 and 2 children per 100,000 live births each year. In contrast, DPHE and EXHE exerted significant negative effect on IMR with β = -.1125 and -.4455 and p<.05 and p<.01 respectively. This implied that US$1 incremental DPHE and EXHE per capital per annum tend to reduce mortality rate by approximately 1 and 4 children per 10,000 live birth each year among the sampled countries. The moderating effect of lnGDPPC and LnTPPL were also negative and statistically significant at 1%.

The F-Stat. of 5775.89 and the associated p-value of .0000 revealed that the combined effect of OPHE, DGHE, DPHE and EXHE is statistically significant at 1%. The R^2 of .8625 also indicated that 86.25% of the changes in the mean infant mortality rate is attributable to variables included in our model, while the 13.75% of the changes in infant mortality rate among the sampled countries were due to other factors not included in the model.

Decision: Based on the above interpretations, we are not expected to accept the null hypothesis three that cost of medical attention does not have statistically significant effect on infant mortality rate. We therefore accepted the alternative hypothesis and concluded that cost

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of medical attention has significant effect of infant mortality rate of the selected African countries.

Table 6: Healthcare expenditure/ cost of medical attention and infant mortality rate nexus for the selected African countries using static panel data estimators

VARIABLES	(1) OLS	(2) FE	(3) GLS	(4) Driscoll-Kray
OPHE	-.2060***	.1981***	.2015***	.1981***
	(.0632)	(.0402)	(.0542)	(.0306)
DGHE	-.2969***	.01712***	.0783***	.01712***
	(.0405)	(.0184)	(.0251)	(.0116)
DPHE	.3784***	-.1125***	.-.0777	-.1125**
	(.0587)	(.0378)	(.0510)	(.0479)
EXHE	-.1553	-.4455***	-.4055***	-.4455***
	(.1046)	(.0458)	(.0623)	(.0701)
lnGDPPC	-22.820***	-8.5070***	-33.3617***	-8.5070***
	(2.1336)	(1.6221)	(1.7230)	(1.5752)
lnTPPL	-3.2756***	-138.2412***	-52.6397***	-138.2412***
	(.9698)	(4.2277)	(3.4041)	(6.8814)
Constant	309.654***	2361.542***	1165.585***	2361.542***
	(21.5895)	(59.6554)	(49.5822)	(101.2787)
Observations	738	738	738	738
Adj. R^2	.4306	.8625	.7834	.8625
country effect	NO	YES	YES	YES
period effect	NO	NO	NO	NO
F-test	93.91	722.59		5775.89
Prob > F	.0000	.0000		.0000
Number of countryid	41	41	41	41
F-test(u_i=0)		223.92		
Prob > F(u_i=0)		.0000		
Wald chi^2			1968.32	
Prob > chi^2			.0000	
Hausman's chi^2		1146.84		
Prob > chi^2		.0000		
Modified Wald Test		93680.21		
		.0000		
Wooldridge Test		5769.13		
		.0000		

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

DISCUSSION OF FINDINGS

This study found that out-of-pocket health expenditure (OPHE) had a negative influence on MLE and FLE and positive effect on IMR. This finding implied that an increase in out-of-pocket expenditure on health further deteriorated male and female life expectancy and increased infant mortality rate. The inconsistencies of these findings with the theoretical *a-priori* expectations are puzzling and can be partly explained by the perceived inefficient and

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ineffective application of out-of-pocket expenditure. These findings further buttressed the UNAIDS (2002) position that most African Countries heavily relied on alternative medicine. The finding can also be explained in part by the prevalent practice of 'self-prescription' or 'self-medication' in the use of orthodox medicine or patronage of quack medical practitioners' prevalence in many of the African countries. However, these findings are consistent with the studies of Matthew, Adegboye and Fashina (2015), and Jaba, Balan and Robu (2014) observed a significant negative relationship between health expenditures and life expectancy but negated Sghari and Hammami (2016) who found no plausible relationship between healthcare expenditure and life expectancy among OECD countries.

The study also found that Domestic Government Expenditure on health (DGHE) positively influenced male life expectancy and female life expectancy is partly consistent with our *a-priori* expectation. However, the observed positive effect of DGHE on IMR is inconsistent with the theoretical framework of the study. This relationship may be due partly to inefficient application of monies voted on health care service delivery by government at all levels of government. This may take the form of purchase of inferior/expired treatment materials or drugs or diversion of budgetary provisions on healthcare service delivery by agencies saddled with provision of healthcare services. The observed positive influence of DGHE and IMR is inconsistent with the findings of Kim and Lane (2013), Novignon, *et. al.,* (2012) who found a negative association between public health expenditure on infant mortality rate. The inconsistencies in these finding can be attributed in part to differences in institutional strengths between the two study environments.

The observed negative influence of DHPE on infant mortality rate and positive effect on MLE and FLE are consistent with both theoretical *a-priori* expectations and the findings of Rahman *et. al.* (2018) who reported that private and public health expenditures have a negative significant effect on infant mortality rate. The findings also support the work of Novignon *et. al.* (2012) who found that private health expenditure had a negative significant effect on mortality rate. Finding from this study is also consistent with Gani (2009) who observed an inverse relationship between per capital health expenditure and infant death per 1,000 life at birth. The result is also consistent with the study of Kiross *et.al.* (2020) who discovered that both public and external health expenditure had a significant negative association with infant mortality rate.

The finding that DPHE exerted positive and statistically significant influence on male and female life expectancy and a negative effect on infant mortality rate is consistent with our *a-priori* expectation. This finding has therefore supported the much-advocated Public Private Partnership in the delivery of critical infrastructure including healthcare facilities. It further strengthens the argument in support of the proposition that Government alone cannot paddle

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the canoe of the health sector especially with the rate of population growth. Seeking Medicare coupled with the clamour for development of economic and social infrastructures such as quality education, aviation, transportation just to mention but a few within the developing countries will exert pressure on the financing structure of developing countries. So therefore, there is the need for government to partner with other health care providers for achieving efficient and effective medical care delivery.

CONCLUSION AND RECOMMENDATIONS

The study concluded that cost of medical attention engendered the desired health outcome in Africa with DGHE, DPHE engendering the desired outcomes. The study therefore recommends that:

i. The government should ensure strict execution and maintain close monitoring on healthcare spending by ensuring that funds appropriated for delivery of healthcare services are utilized for the intended purposes. This function should be carried out by the National Assembly through effective performance of oversight functions and value for money audit of resources voted for healthcare delivery.

ii. The Medical and Dental Council of Nigeria should ensure strict regulation and monitoring of medical practice in Nigeria by ensuring continuous medical professional education for medical practitioners to curb incidence of quackery in medical practice.

iii. The observed negative impact of health expenditure on health outcomes implies lack of co-ordinated approach to health spending especially the out-of-pocket expenditure. It is therefore recommended that the Pharmacists Council of Nigeria enforce the policy of prescription before vending of drug. This will go a long way in ensuring that appropriate medication and dose are administered for ailments which will in-turn improve health outcomes.

iv. The department of traditional, complementary and alternative medicines of the Federal Ministry of Health, States Ministry of Health, the National Agency for Food, Drugs Administration and Control (NAFDAC) are advised to work closely with traditional/alternative providers of medicine for testing the efficacy and possible negative effects and suggest improvement to traditional formulation and prescription of traditional and alternative medicines and develop strategies for systematic inclusion of herbal products that are considered not harmful to health as practiced in China, India and other jurisdictions.

v. It is also recommended that government should put in place deliberate strategies to reduce work and environmental hazards, such as water and air pollution, improved condition of

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service that will assist in ensuring that the positive impact of healthcare expenditure is not eroded by other environmental constraints.

THE WAY FORWARD

This study revealed that health spending from different sources, if properly harnessed, could produce positive health outcomes in terms of low infant mortality rate and high life expectancies for male and female. Government and policy makers are therefore advised to synchronise health expenditures in such a way to optimise outcome. Future research are therefore expected to look at other moderating variables such as level of literacy, urban population, HIV prevalence and physicians per capital.

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