The Effect of Health Expenditure and Immunisation on Under-Five Mortality Rate in Selected African Countries.

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Research

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Abstract

Background: As a way of tackling child mortality, many countries in the world depend on their respective health-care system. But governments of most countries in Africa are yet to provide robust funding of their health-care systems as many people still depend on the out-of-pocket payment to receive health services. Against this backdrop, this study used annual panel data to assess the effect of health-care expenditure and immunisation on the under-five mortality rate in 30 selected African countries for the period 2000-2017.

Methods: Multiple regression technique was adopted for the data analysis and the robust fixed regression estimator was preferred to the random effects as determined by Hausman test.

Results: The findings indicated that domestic government general health expenditure had a significant negative effect on the under-five mortality rate. However, the effect of domestic private health expenditure on under-five mortality was not significant while external health expenditure had a significant negative effect on under-five mortality rate. The impact of diphtheria immunisation on under-five mortality was significant.

Conclusions: Except domestic private health expenditure, government and external forms of health expenditure coupled with diphtheria immunisation were significant factors for the reduction of the under-five mortality in the selected countries.

Background

Children are highly valued and viewed as a vital stakeholder in every culture around the globe. In terms of social security investment and prospects, children provide a window for the present generation to project into the future. Consequently, getting children is an avenue for evaluating success and accomplishment in certain cultures. For this purpose, childbirth generally attracts happiness and celebration among individuals. Marriage without children, on the other hand, is usually characterised by tension and conflict, particularly in Africa. Also, if the couple in question cannot produce at least a child out of it, such a marriage can be considered unproductive and unprofitable in most cultures. At the heart of many divorce cases in Africa for example, is the twin dilemma of barrenness and impotence, and to a lesser degree, male sex orientation and preference. Despite the high premium put on child ownership, child survival in Sub-Saharan Africa remains a major challenge [30].

The concerted efforts aimed at achieving the Millennium Development Goals (MDGs) around the world, especially in developed countries, have reflected a marked decline in infant mortality. But this reduction is not fairly spread as most Sub-Saharan African countries are still battling with the under-five mortality [34]. It has been documented that child mortality outlook in the Sub-Saharan Africa is a gloomy one as the region is still recording the worst Under-Five Mortality Rate (UFMR) in the world [36]. It is alarming to note that 98% of the global under-five deaths occur in 42 less developed countries [30]. Optimistically, however, it has been estimated that the Sustainable Development Goal (SDG) target of 25% decrease in

under-five mortality by 2030 [24] is likely to be reached by a few Sub-Saharan African countries if other variables remain constant.

Medically, certain vaccine-preventable diseases such as measles, pertussis, diphtheria, polio, tuberculosis and tetanus have been linked to child mortality [23]. The problem of child mortality is remotely and complexly related to certain living conditions such as access to clean drinking water and sanitation facilities [36]. Interestingly, as captured in both the MDG4 and Sustainable Development Goals (SDGs), under-five mortality, which is the death of a child from day one to five years, has generated a great deal of interest and concern [32]. The phenomenon of child mortality transcends medical causes to include certain socio-economic and demographic variables in a broader context. As several studies [35, 18, 5] have suggested, a multi-dimensional approach is needed to tackle this menace.

In different but related studies, a mother's age was considered as a non-factor for the uneven distribution of mortality under the age of five [35, 32]. Some scholars have further noted that house settlement patterns and rural-urban differentials were risk factors for child mortality [3, 12, 15]. Health care systems, health care financing, poverty and access to maternal health services are remotely and complexly identified as correlates of child mortality [31, 33, 39, 1]. For example, as a complex phenomenon, child mortality has been largely associated with maternal health status because children under-five years of age have always been considered to be under the custody of their mothers except in certain exceptional circumstances. Consequently, the conditions of mothers influence the survival chances of the children [30].

Child death has some cross-cutting impacts on culture, economics, government and families as a significant public health problem for the population. For example, based on the infant mortality trend study of 2,976 million child deaths as of 2013, it was estimated that the African continent would suffer the effect of child deaths amounting to around 6 percent of its non-health Gross Domestic Product (GDP) [20]. Rising infant mortality still has the ability in the near future to decrease the productive influence of the working community. Moreover, infant death leaves behind some devastating physical, psychological and emotional impacts on family members. Child death deprives ageing parents of future care in Africa, where the care of elderly persons is one of the major traditional responsibilities of family members.

As a way of tackling child mortality, many countries in the world depend on their respective health-care system. But governments of most countries in Africa are yet to provide robust funding of their health-care systems as many people still depend on the out-of-pocket payment to receive health services. Similarly, child immunisation in Africa is still being confronted by myriad of challenges ranging from religious belief, negative politicising, geographical inaccessibility, to poor or lack of physical infrastructural facilities. In the light of the foregoing, this study assessed effects of health care expenditure and immunisation on the under-five mortality rate in selected African countries for the period of 17 years (2000–2017). In measurable terms, the study is bound by the following specific objectives, namely to: assess the effect of Domestic Government General Expenditure on Health (DGGEH) on Under-Five Mortality Rate (UFMR) in selected African countries; assess the effect of Domestic Private Health

Expenditure (DPHE) on under-five mortality rate; examine the impact of External Health Expenditure (EHE) on UFMR in the selected countries; examine the impact of Diphtheria Immunisation (DI) on UFMR in the selected African countries.

Domestic government general expenditure on health is used as one of the proxies for health expenditure in this study. It can be referred to both capital and recurrent health expenditure of the government, including revenue as domestic grants, transfers, health subsidies, organisational health financing programmes, voluntary health insurance beneficiaries and national health insurance scheme [21]. Some documented studies have linked health expenditure to health outcomes (child mortality). Some of these studies used data from time series in the health economics literature, while others used panel data sets. A study found a significant long-term association between government spending on health and child mortality in several developing countries [22]. Similarly, several different but related study results found that government spending on health was significantly associated with decreasing child mortality [4, 8, 6, 11, 21]. In contrast, a few studies have found that public health spending in high-income countries has not had a significant impact on child mortality [10, 2].

Another form of expenditure is Domestic Private Health Expenditure (DPHE). This encompasses household out-of pocket, funds from corporations and non-governmental organisations. A group of authors has noted that DPHE had a significant influence on under-five mortality [22]. That is, private expenditure on health reduced child mortality significantly. Also, total health expenditure in 47 African countries has been found to have a significant impact on under-five mortality [4]. However, another study discovered that the association between private health spending and child mortality was negligible one [21]. As part of the expenditure component, External Health Expenditure (EHE) comprises all financial inflows and resources that come into the national health system from outside the country [21]. More importantly, the issue is the effects of such inflows and resources on the health outcome like child mortality. Against this background, it was opined that external spending on health in the form of aid had a significant impact on the mortality of children under five [25]. Another research has also reaffirmed that external health investment is strongly correlated with child and neonatal mortality [21]. In the same way, a study showed that when external health resources are improved, they contribute to a reduction in infant mortality [8]. A research affecting 10 selected African countries equally found that external health spending in the form of aids and immunisation was an effective factor in reducing mortality for children under five [2].

One of the main ways of addressing childhood morbidity worldwide has been the regular and periodic immunisation of children under five. Some of the diseases that can be treated by the Expanded Immunisation Programme (EPI) include measles, pertussis, diphtheria, polio, tuberculosis, and tetanus (Matthews and Diamond, 1999). However, the interest of this study is partly to assess the effect of diphtheria immunisation (% of children ages 12–23 months) on the under-five mortality rate in selected African countries. In addition, a couple of studies have stated that immunisation is an important factor in reducing the mortality of children [26, 7]. Similarly, it has been revealed that immunisation raises the probability of infant survival and was viewed as one of the most effective ways to stem the tide of child

mortality [37]. The accessible literature reviewed in this study has indicated that there is still a need for further research relating private health spending, external health expenditure and immunisation to under-five mortality, as the current body of literature on the topic still leaves some gaps. Besides, the time frame covered in the available literature needs to be updated as the current study fills in the gaps in terms of time frame (2000–2017) and combined variables (health care expenditure and immunisation).

With regard to the theoretical perspective, Grossman's health production and investment model is being adopted for this research. According to Becker, health in this case is conceptualised as both a consumable item and an investment resource [29]. The model opined that an individual chooses their level of health and by extension, their life span. It further postulated that time was a variable factor that contributes to declining health status in both objective and subjective terms. However, through certain social determinants such as diet, exercise, medical care and life-style decisions, it could be replenished and counter-balanced. On the other hand, ageing, smoking, extreme opioid use and exposure to other toxic compounds may make the health capital of an individual depreciate. In this context, the level of health an individual has is a function of the amount of resources allocated to its investment. Also, an individual is viewed as a “manufacturer” as well as a “user” of health and that the demand for health is not for immediate consumption but for the production of other goods. So, one’s level of health is not attributed to certain external social factors but endogenously influenced. In other words, Grossman's main argument for health investment is that health care services are not requested for their own purposes, but for the impact on health itself. Ageing influences the state of health and requires constant health care services. However, the impact of ageing on wellbeing is mitigated by educational level and a balanced style of living [29].

The model can be sustained in this study when health expenditure (domestic government general, domestic private, external health expenditures and diphtheria immunisation) is viewed as an investment tailored towards improving maternal and child health status (reduction in under-five mortality). In this case, expenditure on and utilisation of maternal and child health services is considered as derived demand capable of impacting on child mortality rate. Within the theoretical purview of the household health production function of Grossman, both increase and decrease in child mortality is predicated on the amount of resources allocated to health. It is taken for granted that more increase in health and education is likely to translate into reduction in under-five mortality in the selected African countries. Moreover, it can be deduced that the age-long uneven distribution of child mortality across and within various regions of the world is neither accidental nor incidental but it can be related to varying investment in health capital among other factors. “Other things being equal”, the insightful understanding of Grossman’s model is that, more investment in health capital leads to desirable child health status and by extension declining child mortality. Even though Grossman’s model is subject to some methodological and empirical flaws, however, the theory has continued to stand the test of time with regard to investment in health capital.

Methods

The aim of the study is to assess the effect of health expenditure and immunisation on under-five mortality rate in selected African countries. The *ex post facto* research design was considered as appropriate for the study since it involved examining the statistical effects of the independent or explanatory variables on the dependent or outcome variable over past time. The independent variable in this study is health expenditure, which is proxied by Domestic Government General Expenditure on Health (DGGEH), Domestic Private Health Expenditure (DPHE) and External Health Expenditure (EHE). Immunisation as an independent variable is also represented by Diphtheria Immunisation (DI). On the other hand, Under-Five Mortality Rate (UFMR) serves as the dependent variable.

Data Description and Sources

The study utilised the annual panel data that comprised 30 African countries for the period of 17 years (2000-2017). The data were sourced from the 2017 published reports and accounts of the World Bank on the world development indicators. Meanwhile, the filter criteria for selecting the 30 countries were based on the availability of the annual data spanning 2000-2017. It means the study has balanced panel data with 540 observations. The list of the selected company is hereby attached as an appendix. The study adopted multiple regression technique for the data analysis because of several independent variables involved. This is to enable the authors to determine the impacts of DGGEH, DPHE, EHE and DI on UFMR in the selected countries. The analysis of data was facilitated by the application of STATA 12 software version and the study hypotheses were extrapolated from the results and tested at the pre-determined 5% level of significance. The analysis was patterned after the econometric styles used in the literature [4, 8, 22, 21]. Moreover, to ensure the validity of the results, several robustness tests were conducted to check for multicollinearity, heteroskedasticity, data normality and model specification. The results of the various tests eventually necessitated the decision to adopt the robust fixed effects regression model.

Model Specification

General Panel Linear Model

$$Y_{it} = a_i + \beta_1 X'_{1it} + \beta_2 X'_{2it} + e_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$logUFMR = F(DGGEH, DPHE, EHE, logDI) \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Econometric model:

$$logUFMR_{it} = a + \beta_1 DGGEH_{it} + \beta_2 DPHE_{it} + \beta_3 EHE_{it} + \beta_4 logDI_{it} + e_{it} \ldots\ldots\ldots (3)$$

Where: β1- β4=parameters to be estimated with a priori expectations; UFMR= Under-Five Mortality Rate (per, 1,000 live births) as the dependent variable; DGGEH = Domestic Government General Expenditure on Health (% of Gross Domestic Product) as an independent variable; DPHE = Domestic Private Health Expenditure % of (Current Health Expenditure) as an independent variable; EHE= External Health Expenditure (% of Current Health Expenditure) as an independent variable; DI= Diphtheria Immunisation

(% of children ages 12-23 months); α= Constant; e = Error term; i = countries and t = Period. **Note:** UFMR and DI were in their natural log forms.

Results

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
UFMR	540	90.96896	45.0766	17.1	234
DGGEH	540	1.786976	1.057063	.062362	5.275046
DPHE	540	47.03394	16.88815	8.119548	83.63081
EHE	540	19.77534	17.491	.0122321	79.9847
DI	540	75.8537	20.36155	8	99

Source: Researchers' Computation using STATA 12.0 software

It can be deduced from Table 1 above that the average Under-Five Mortality Rate (UFMR) in the selected countries for the period under review stood at 90.968 per 1, 000 live births; with the minimum and the maximum UFMR being 17.1 and 234 per 1, 000 live births. In addition, Domestic Government General Health Expenditure (DGGHE) accounted for an average of 1.786; with the minimum and maximum being 0.062 and 5.275 respectively within the same period (2000-2017). It has been noted that DDGGHE shows the standard deviation of 1.057 from its mean. On the average, Domestic Private Health Expenditure (DPHE) and External Health Expenditure (EHE) in the selected countries were 47.033 and 19.775. On the other hand, the maximum DPHE and EHE were 83.630 and 79.984 while the minimum stood at 8.119 and 0.012 respectively. Similarly, the average Diphtheria Immunisation (DI) of children ages 12-23 months was 75.85% while the maximum and the minimum number of under-5 children that received DI accounted for 99% and 8% proportionately across the selected African countries. Given the respective standard deviations of all the variables (45.076, 1.057, 16.888, 17.491 and 20.361) being lower than their corresponding mean values, it suggests that the variables had slow growths within the period under review.

Table 2: Correlation matrix Test for Multicollinearity

Variable	UFMR	DGGEH	DPHE	EHE	DI
UFMR	1.0000				
DGGEH	-0.4005	1.0000			
DPHE	0.2966	-0.3780	1.0000		
EHE	0.0922	-0.2811	-0.5136	1.0000	
DI	-0.6836	0.3547	-0.3360	0.1948	1.0000

Source: Researchers' Computation using STATA 12.0 software

To ascertain whether multicollinearity among the explanatory variables was a problem in the analysis or not, the authors adopted the Pearson correlation test. The result in Table 2 above shows that Domestic Private Health Expenditure (DPHE) has a negatively weak relationship with Domestic Government General Expenditure on Health (DGGEH) as indicated by the correlation coefficient of 37%. Similarly, weak and moderate negative relationship was noted to have existed between External Health Expenditure (EHE) on one hand, and DGGEH and DPHE on the other hand as shown by the corresponding coefficients of 28% and 51%. It was also observed that Diphtheria Immunisation (DI) and Domestic Government General Expenditure on Health (DGGEH) were weakly and negatively correlated by 35%. Meanwhile, there was a weak (33%) and negative relationship between DI and DPHE in the same table above. When DI was further correlated with EHE, it equally showed a negatively weak relationship as represented by the coefficient of 19%. Since the correlational relationships between the independent variables have not exceeded the 85% "rule-of-thumb" suggested in the literature [17, 16], it could be deduced that multicollinearity was not an issue or a problem in this study. However, the authors subjected the deduction to the test of the Variance Inflation Factor (VIF) for further validation in order to avoid any doubt of inflated results or spurious regression outcome.

Table 3: Test for Multicollinearity using Variance Inflation Factor (VIF)

	DPHE	EHE	DGGEH	DI
VIF	2.27	2.24	2.06	1.28
1/VIF	0.439903	0.446048	0.484265	0.779996

Source: Researchers' Computation using STATA 12.0 software

From Table 3, the Variance Inflation Factor (VIF) values of the independent variables were less than 10; which implies a total absence of multicollinearity in the analysis of the independent variable components. This is also in tandem with the recommendation in the existing literature [28].

Table 4: Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

chi2(1)	4.41
Prob > chi2	0.0358

Source: Researchers' Computation using STATA 12.0 software

At this juncture, the problem of heteroskedasticity in the model has been detected as revealed in Table 4 above. The Breusch Pagan/Cook-Weisberg test shows the chi2 (1) value of 4.41 and the corresponding probability value of 0.035 which is statistically significant at 1% alpha level (p-value < 0.05). Consequently, the problem of heteroskedasticity in the model has flouted the homoskedastic principle of the general linear regression model. It was on this basis that the authors considered it imperative to correct the pitfall by adopting the robust fixed effect regression model after conducting the Hausman specification test.

Table 5: Shapiro-Francia W' Test for Normal Data

Varaibles	Obs	W'	V'	Z	Prob>Z
UFMR	540	0.97080	11.281	5.342	0.00001
DGGEH	540	0.92117	30.460	7.532	0.00001
DPHE	540	0.98892	4.281	3.206	0.00067
EHE	540	0.90715	35.875	7.892	0.00001
DI	540	0.90436	36.954	7.958	0.00001

Source: Researchers' Computation using STATA 12.0 software

Shapiro-Francia W' Test for normal data in Table 5 revealed that UFMR, DGGEH, DPHE, EHE and DI did not follow the normal pattern of distribution around their central means as shown in the respective probability values of less than 0.05 level of significance. Again, an assumption of the general linear regression model of normal distribution of data has been violated at this point. The possible approach to be adopted was the robust fixed effect estimator to correct this statistical anomaly.

Table 6: Hausman Specification Test

Chi2	1954.27
Prob. Chi2	0.0000

Source: Researchers' Computation using STATA 12.0 software

Since the study involved the panel data, the authors opted for the Hausman specification test to determine whether the fixed effects or the random effects estimator was appropriate. The result of the

Hausman test suggested the robust fixed effect model being appropriate for this study as indicated by in the chi2 value of 1954.27 and the corresponding significant Prob. Chi2 of 0.000. Besides, the problem of the non-normal distribution of the data equally warranted the application of the robust fixed effect model.

Table 7: Robust Fixed Effect Regression

		Robust		
LogUFMR	Coef.	Std. Err.	T	p>|t|
DGGEH	-.1283442	.0615876	-2.08	0.046
DPHE	.0029441	.0040208	0.73	0.470
EHE	-.0117876	.002837	-4.16	0.000
LogDI	-.5340983	.0917289	-5.82	0.000
_cons	6.978459	.5409469	12.90	0.000
Overall R-sq	0.1696			
F-Statistic	21.06			
Prob. >F	0.0000			

Source: Researchers' Computation using STATA 12.0 software

For the period under review, the result from Table 7 above reflects the overall coefficient of determination of 0.169. This suggested that the independent variables, namely: DGGEH, DPHE, EHE and DI exerted an estimate of 16% joint effects on the changes in the dependent variable (UFMR) for the period. The probability value of the F-Statistic is significant at 1% which implies the fitness of the study model and its suitability for reliable decision making.

Test of Hypotheses

Ho1: Domestic government general expenditure on health has no significant impact on under-five mortality rate in selected African countries.

Ho2: Domestic private health expenditure has no significant effect on under-five mortality rate in the selected countries.

Ho3: External health expenditure has no significant effect on under-five mortality rate in the selected countries.

Ho4: Diphtheria immunisation has no significant effect on under-five mortality rate in the selected African countries.

It was noted in Table 7 that the domestic government general expenditure on health had a significant negative effect on the under-five mortality rate in the 30 selected African countries as shown in the probability value less than 5% (0.046) and the corresponding coefficient of -.128. On the strength of this result, the null hypothesis which stated that domestic government general expenditure on health has no significant impact on under-five mortality rate is hereby rejected. Also, the impact of domestic private health expenditure on under-five mortality was not significant as reflected in the probability value of 0.470 (47%) which is above the a priori assumption of 5% level of significance and the coefficient of 0.002 respectively. In consequence, the null hypothesis which stated that domestic private health expenditure has no significant effect on under-five mortality rate is accepted.

Furthermore, the result in Table 7 shows that external health expenditure exerted a significant negative effect on under-five mortality rate. This was underscored by the P-value of 0.000 and the coefficient of -0.0117. Since the P-value is significant at 1%, the null hypothesis three (Ho3) is rejected. Similarly, diphtheria immunisation has a significant negative effect on under-five mortality as indicated by the P-value of 0.000 and the corresponding coefficient of -0.534. On this premise, the null hypothesis which stated that diphtheria immunisation has no significant effect on under-five mortality rate in the selected African countries is hereby rejected.

Discussion

The study revealed that domestic government general expenditure on health had a significant negative effect on the under-five mortality rate in the 30 selected African countries. This shows that a 1 percent unit increase in government health spending will reduce under-five mortality rate by -0.128 if other variables are held constant. The finding is consistent with some previous studies [22, 4, 8, 6,11, 21]. However, it is at variance with a study involving some high income countries where no significant relationship was found between public health spending and child mortality [10].

Contrary to the a priori expectation, this study found that the impact of domestic private health expenditure on under-five mortality was not significant. Similarly, when other variables remain unchanged, a unit increase in domestic private health expenditure will lead to an increase of 0.002 in under-five mortality rate per time. While the finding is in agreement with a couple of studies conducted in the previous years [4, 22], it is however, in contrast to some other studies [26, 2]. Moreover, the study found that external health expenditure had a significant negative effect on under-five mortality rate for the period under review. Also, an increase of 1% in external health expenditure will produce a corresponding negative impact on under-five mortality rate in the 30 African countries within the determined time frame. The above finding is in consonance with some studies in the literature [25, 8, 4, 21]. Moreover, immunisation in the form of diphtheria was found to have a significant negative effect on under-five mortality. In other words, holding domestic government general health expenditure, domestic private health expenditure and external health expenditure constant, 1% increase in immunisation will lead to -0.534 significant decline in the under-five mortality. The above finding is anchored on some previous

studies [26, 7, 4] that established a negative significant relationship between immunisation of children and child mortality.

Research Limitations:

This study assessed the effects of health care expenditure and immunisation on the under-five mortality in selected African countries for the period of 17 years (2000-2017). However, it did not differentiate the effects of health care expenditure and immunisation on the under-five mortality of individual countries. Moreover, this study did not cover other socio-cultural, economic and political factors that underscore the under-five mortality in the affected countries. Notwithstanding, the study provides a basis for regional comparison vis a vis other parts of the world.

Conclusions

To tackle the problem of the under-five mortality in African countries, a multi-dimensional approach is required as this study indicated it. Apparently, government general health expenditure, external health-care expenditure and diphtheria immunisation have been noted as significant factors for the reduction of the under-five mortality in the selected countries. On the other hand, domestic private health expenditure did not have any significant contributory impact on the under-five mortality rate. This may not be unconnected with the harsh socio-economic realities prevalent in most African countries that constrain access to antenatal, prenatal and post-natal health care services. So, many mothers and their under-five children rely more on health services being offered by government.

On the basis of the study findings above, it is suggested that governments of the various African countries should step up domestic health expenditure in the area of maternal and child health. Besides, the issue of diversion of funds meant for the health sector by some corrupt individuals and their syndicates must be checkmated by the various governments if the intended health outcome must be maximised. The countries should create an enabling environment comprising good roads, electricity, pipe-borne water, security and other health-related infrastructure that may attract more grants for maternal and child health from international external sources.

Also, the governments of African region should pool their resources together and start the production of vaccines locally to address the issue of certain childhood killer diseases like diphtheria, measles, tuberculosis and many other preventable health afflictions, instead of relying on the foreign-based vaccines for immunisation. This is so because a time may come that the donor agencies supporting the immunisation of the under-five African children may not be able to sustain it due to some unforeseeable circumstances and vagaries surrounding international politics and economy. African governments should try and make access to maternal and child health-care services free and compulsory for mothers and their under-five children. In effect, it may help to solve the problem of access and further reduce the challenge of the under-five mortality in the region.

Abbreviations

MDGs=Millennium Development Goals; UFMR=Under-Five Mortality Rate; SDG= Sustainable Development Goal; GDP= Gross Domestic Product; DGGEH= Domestic Government General Expenditure on Health; DPHE= Domestic Private Health Expenditure; EHE= External Health Expenditure; DI= Diphtheria Immunisation; EPI= Expanded Immunisation Programme; Log= logarithm and VIF= Variance Inflation Factor.

Declarations

Ethics Approval and Consent to Participate: Not applicable

Consent for Publication: Not applicable.

Availability of Data and Materials: The data used for this study could be accessed from the World Bank annual report on the human development index.

Competing Interest: The authors hereby declare no potential competing interest regarding the article and its authorship.

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Authors' Contributions: EA conceived the study, sourced and analysed the data, including the preparation of the manuscript. Meanwhile, SM guided the entire process from designing to writing. This is in addition to fine-tuning the manuscript editorially. However, both EA and SM read and approved the manuscript before submission.

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