

Effect of Government Healthcare Interventions on Health Outcomes in Nigeria, 2000-2024

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ABSTRACT: This study investigates the effect of government health intervention on health outcomes in Nigeria for the period 2000 – 2024. Public health intervention is proxied with government health expenditure per capita, health insurance enrolment rate, health workforce density and average vaccination coverage rate. Public health intervention is represented by maternal mortality rate, infant mortality rate and life expectancy. The study has four specific objectives which are to analyze the effects of government health expenditure per capita, health insurance enrolment rate, health workforce density, average vaccination coverage rate on the health outcomes. Data are sourced from World Bank, Central Bank of Nigeria and World Health Organization, and analyzed using the auto Regressive Distributed Lag (ARDL) model. The results indicate that public health expenditure per capita did not significantly increase maternal and infant mortality but it has decreasing effect on life expectancy. Health insurance enrollment rate significantly decreases maternal mortality but has increasing effect on infant mortality and life expectancy. Health workforce density decreases both maternal and infant mortality significantly and increases life expectancy significantly while average vaccination coverage rate insignificantly increases maternal mortality but decreases infant mortality and life expectancy though not significantly. The conclusion is that health workforce development represents the most critical health intervention effort of the Nigerian government. By implication, policies aimed at increasing equitable distribution of healthcare personnel will yield greater health outcomes rather than increased spending alone.

KEYWORDS: Government health intervention, health outcomes, health insurance, infant mortality, life expectancy, maternal mortality, vaccination coverage

1. INTRODUCTION

Health is a fundamental human right and an important component of economic and social development. A healthy population inspires labour productivity, human capital accumulation and educational attainment which improves overall economic growth and development. Governments worldwide strive to implement various health intervention programs in order to improve population health outcomes. Developing countries are not left out as the government engage in public health financing, insurance schemes, workforce development, immunization programmes, etc. The effectiveness of such health interventions has remained a major concern because Nigeria continues to bear a disproportionate share of the global burden of maternal and child mortality despite decades of health sector reforms (World Health Organization [WHO], 2025).

Nigeria presents a particularly important case for examining the relationship between government health interventions and health outcomes. As Africa's most populous nation, with an estimated population exceeding 220 million people, Nigeria accounts for a significant share of global maternal and child deaths despite being one of the continent's largest economies (WHO, 2025). Since independence in 1960, the Nigerian government has pursued multiple health-sector interventions aimed at improving population health. Early post-independence efforts focused on expanding healthcare infrastructure and increasing access to primary healthcare services. The Alma-Ata Declaration of 1978 subsequently influenced the adoption of the Primary Health Care (PHC) approach, culminating in the launch of Nigeria's national PHC programme in the 1980s. More recent reforms include the establishment of the National Health Insurance Scheme (NHIS) in 2005 (now National Health Insurance Authority, NHIA), the enactment of the National Health Act in 2014, the Basic Health Care Provision Fund (BHCPF) in 2018, and sustained investments in routine immunization and health workforce development (Hafez, 2018; Onwujekwe et al., 2025).

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One of the most important government interventions intended to improve health outcomes is public health expenditure. Nigeria's public health spending has historically remained below international recommendations. Following the Abuja Declaration of 2001, African governments committed to allocating at least 15% of annual public expenditure to the health sector (Ophori, Tule, Azih, et al., 2014). Yet Nigeria has consistently fallen short of this target, with health expenditure often accounting for less than 10% of total government expenditure (Central bank of Nigeria [CBN], 2024). Health insurance represents another critical government intervention designed to improve financial access to healthcare. The NHIS was introduced in 2005 to reduce catastrophic health expenditures and promote universal health coverage. Although coverage has expanded over time, enrolment remains relatively low compared with the national population (Ekhatior-Mobayode et al., 2022; Onwujekwe et al., 2025). Health insurance coverage in Nigeria stands at approximately 10% of the population, with over 20 million Nigerians enrolled across various national and state schemes. What this implies is that about 90% of Nigerians remain uninsured and continue to finance medical expenses independently through out-of-pocket payments (NHIA, 2025). Olatunji, Aderinto, Kokori and Abraham (2024) reported that as at end of 2024, Nigeria has a health workforce density of approximately 1.83 to 1.95 skilled health workers per 1,000 people, which falls significantly short of the World Health Organization recommended minimum threshold of 4.45 health workers per 1,000 people.

Furthermore, the national routine vaccination coverage in Nigeria averages approximately 56% for DPT3 (Pentavalent-3), 84.2% for Measles, and around 62% to 67.5% for the third dose of Polio (OPV3) among eligible children (Mafiana, Shen, Hu & Wang, 2022; Wollum, Burstein, Fullman, et al., 2015). These rates, according to World Bank (2024), fall below the World Health Organization's goal of $\geq 90\%$ coverage and feature severe regional disparities.

Nigeria continues to experience poor health outcomes relative to global and regional benchmarks. Maternal mortality remains among the highest in the world. According to the WHO, UNICEF, World Bank Group and United Nations Population Division estimates, Nigeria accounted for the largest number of maternal deaths globally in 2023 and contributed a substantial proportion of worldwide maternal mortality burden (WHO, 2025). Although the maternal mortality ratio declined from levels exceeding 1,100 deaths per 100,000 live births in 2000 to below 1,000 per 100,000 live births in recent years, progress remains insufficient to achieve Sustainable Development Goal (SDG) Target 3.1, which seeks to reduce maternal mortality to fewer than 70 deaths per 100,000 live births by 2030 (WHO, 2025). Data from the World Bank indicate that infant mortality declined from approximately 107 deaths per 1,000 live births in the early 1990s to below 55 deaths per 1,000 live births in recent years. Nonetheless, infant mortality remains considerably higher than the global average and continues to represent a major public health challenge (World Bank, 2024). Life expectancy at birth has also increased from approximately 46 years in 2000 to about 55 years in recent years, reflecting modest gains in healthcare delivery and disease control. However, Nigeria still ranks among countries with relatively low life expectancy, suggesting persistent deficiencies in healthcare access, quality, and financing (World Bank, 2024).

The statistics of health outcomes in Nigeria points to the fact that government health intervention may not actually be sufficient to improve the health outcomes in the present and the nearest future. However, given the current government implementation of several health-sector reforms, maternal mortality, infant mortality, and life expectancy indicators remain a major public health concern. For instance, government health expenditure per capita remains low below \$90 compared to global and regional average benchmarks of over \$1,000. Health insurance coverage is still limited despite the transition from the National Health Insurance Scheme (NHIS) to the National Health Insurance Authority (NHIA). Available estimates suggest that fewer than one-fifth of Nigerians are covered by formal health insurance arrangements, leaving a substantial proportion of the population exposed to out-of-pocket healthcare financing (Onwujekwe et al., 2025). Similarly, Nigeria continues to experience shortages of skilled healthcare personnel, with physician, nurse, and midwife density remaining below the World Health Organization's recommended threshold for achieving universal health coverage (WHO, 2025). Furthermore, routine childhood immunization coverage remains suboptimal. Recent national estimates indicate DPT3 (Pentavalent-3) coverage of approximately 56%, while routine polio (POL3) and measles (MCV1) vaccination coverage have improved but remain below levels required for herd immunity and sustained disease elimination (WHO, 2024; Mafiana et al., 2022).

Notwithstanding these interventions, the direction and magnitude of their effects on health outcomes remain uncertain. While increased public health expenditure is theoretically expected to improve healthcare access and quality, inefficiencies in resource allocation and governance may weaken its impact. Therefore, the motivation for this study lies in the need to forecast future health outcomes given the current trajectory of government health interventions. It appears that the current down-trend in various health outcome indicators may be as a result of policy inconsistencies resulting from the uncertain relationship between government health intervention and health outcomes. Solving this problem through econometric forecast will help direct the Nigerian economy on the path to sustainable growth through effective prediction of health outcomes and government health intervention magnitude.

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Furthermore, empirical evidence on the extent to which public health expenditure per capita, health insurance enrolment, health workforce density, and vaccination coverage affect maternal mortality, infant mortality, and life expectancy in Nigeria remains inconclusive. While some studies reported positive effect of public health intervention on life expectancy and decreasing effect on infant and maternal mortality (Edeme, Emecheta, & Omeje, 2021; Awoyemi et al., 2023; Olayiwola et al., 2024), other studies found decreasing effect of public health expenditure on life expectancy while also increasing infant and maternal mortality (Azuh et al., 2020; Adewumi, Acca, & Afolayan, 2021). This uncertainty underscores the need for rigorous empirical investigation to unravel the individual and combined effects of these government health interventions on health outcomes in Nigeria. Stemming from the problems above, the study's main aim is to determine the effect of government health intervention on health outcomes in Nigeria. The specific objectives of the study are to:

1. determine the effect of public health expenditure per capita on maternal mortality, infant mortality and life expectancy;
2. investigate the extent to which health insurance enrolment rate has affected maternal mortality, infant mortality and life expectancy;
3. analyze the relationship between health workforce density and maternal mortality, infant mortality and life expectancy.
4. Ascertain the effect of average DPT3, measles, polio vaccination coverage rate on maternal mortality, infant mortality and life expectancy in Nigeria.

These specific objectives are transformed into research hypotheses which are stated in their null forms as follows:

- H₀₁: Public health expenditure per capita has no significant effect on maternal mortality, infant mortality and life expectancy in Nigeria.
- H₀₂: health insurance enrolment rate has no significant effect on maternal mortality, infant mortality and life expectancy in Nigeria.
- H₀₃: There is no significant effect of health workforce density on maternal mortality, infant mortality and life expectancy in Nigeria.
- H₀₄: Average DPT3, measles, polio vaccination coverage rate has no significant effect on maternal mortality, infant mortality and life expectancy in Nigeria.

2. LITERATURE REVIEW

Government healthcare interventions in Nigeria are anchored on policies, financing, and programs designed to promote universal health coverage (UHC). Historically, Nigeria's health policy frameworks such as the National Health Policy of 1988, the National Health Act of 2014, the Basic Health Care Provision Fund (BHCPF), health workforce strategic plan of 2024, digital health strategic framework of 2025, etc. have shaped how healthcare interventions are delivered. According to World Health Organization (2020), Government interventions are often categorized into preventive, curative, and systemic reforms.

Preventive interventions include immunization programs, maternal and child health initiatives, and health education campaigns. For example, the National Program on Immunization (NPI) contributed to the eradication of wild poliovirus in Nigeria in 2020 (WHO, 2020). Curative interventions involve expanding public hospitals and providing subsidized treatment for priority diseases like malaria and tuberculosis (Atun et al., 2010). Systemic reforms include the establishment of the National Health Insurance Scheme (NHIS) in 2005 to enhance access to healthcare financing (WHO, 2020). For the purpose of this research, government health intervention is proxied with public health expenditure per capita, health insurance enrolment rate, health workforce density, and average DPT3, measles, polio vaccination coverage rate.

By way of conceptualization, public health expenditure per capita is defined as the amount of government financial resources that are allocated to health services and programmes divided by the total population (Bokhari, Gai, & Gottret, 2007). In other words, it measures the amount government spends on health services per individual in the country. Health insurance enrolment rate refers to the proportion of the population that are currently covered under a health insurance scheme per year (Ekhatior-Mobayode, Gajanan, & Ekhatior, 2022). It is widely used as a health intervention strategy by the government to reduce reliance on out-of-pocket health expenditure. Furthermore, Campbell et al. (2013) defined health workforce density as the number of skilled health professionals that are available per 1,000 population. Vaccination coverage rate is the percentage of target population that have received recommended diphtheria-pertussis-tetanus (DPT3) vaccine, measles vaccine and polio vaccine within a year (Bos et al., 2024). These variables when put together in this study measure the extent of government health interventions.

According to the World Health Organization (WHO, 2018), "health outcomes are the end results of healthcare practices, programs, or policies, reflected in indicators such as morbidity, mortality, life expectancy, and quality of life." Finkelstein et al. (2019) describe health outcomes as "the measurable effects of healthcare access and utilization on the physical, mental, and social well-being of populations." Three important health outcome indicators—life expectancy, infant mortality, and maternal mortality rate—are

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especially pertinent in the context of this study. Excluding unintentional or incidental causes, maternal mortality is defined as deaths resulting from problems during pregnancy, childbirth, or within 42 days following delivery (WHO, 2020). The number of newborn deaths per 1,000 live births in a given year is known as the infant mortality rate (WHO, 2023). The average number of years a newborn is predicted to live, assuming present mortality rates stay the same, is known as life expectancy at birth (UNDP, 2022).

The main theory adopted in this research, which explains the nexus between government health intervention and health outcomes, is the health capital theory developed by Grossman (1972). According to the theory, health is seen as a durable capital stock that encourages an individual to increase their productivity. The theory sees health as both consumption good and investment good enhancing an individual's ability to work and generate income (Grossman, 2000; Mashevskaya & Yuting, 2025). Over time, Yuan and Yang (2025) noted that health depreciates due to aging and illness but this can be remedied through increased investment in medical care, preventive health services, nutrition and education. Thus, government health interventions represents an important mechanism through which investments in health capital are enhanced and this ultimately results in improved health outcomes such as reduction in maternal and infant mortality, and increased life expectancy. Thus, the health capital theory predicts a direct relationship between government health interventions and population health outcomes.

Several studies have linked government health interventions with various aspects of health outcomes. Azuh, Osabohien, Orbih, and Godwin's (2020) study examined the relationship between government health spending and under-five mortality in Nigeria. The analysis demonstrated a statistically significant association between public health spending and under-five mortality using the autoregressive distribution lag approach. Abbas (2020) used the health demand function and health production function to estimate the various macroeconomic and policy-relevant factors influencing public health spending and health status in Pakistan over time as well as the likely impact of health-related variables like health status and per-capita calorie availability on economic development. Per-capita health spending was favourably correlated with female life expectancy and negatively correlated with the newborn mortality rate, according to the co-integration and Granger-causality studies.

The impact of government health spending on health outcomes in Nigeria was studied by Adewumi, Acca, and Afolayan (2021). The study found that government health expenditure per capita had a positive relationship with the country's neonatal, child, and infant mortality rates. Obisike, Iwuchukwu, and Unegbu (2021) used an error correction model to find that public health spending, private health expenditure, foreign assistance on health and health education had a positive impact on newborns protected against tetanus, the success rate of tuberculosis treatment, and the prevention of measles through immunisation. Edeme, Emecheta, and Omeje (2021) demonstrated a long-term equilibrium link between public health spending and health outcomes. The findings also demonstrated that raising public health spending increases life expectancy and lowers infant death rates.

The elasticity of maternal and under-five mortality in relation to government health spending and income was calculated by Bokhari, Gai, and Gottret (2007). According to the analysis, more public health spending was linked to better population health and dramatically decreased maternal and under-five mortality. The impact of health financing and governance quality on health outcomes in Nigeria between 1980 and 2018 was investigated by Akintunde, Adesine, and Akinrinde (2022). The results, which were obtained using the vector error correction model (VECM), showed that efficient health financing greatly improves health outcomes when it is backed by robust governance structures.

Rezapour, Mousavi, Lotfi, Movahed, and Alipour (2022) examined how various health spending levels affected health indicators such as life expectancy, infant mortality rate, and under-five mortality rate. According to the study, public health spending improves health status by producing favourable external consequences and is more effective than private health spending. Awoyemi, Makanju, Mpapalika, and Ekpeyo (2023) discovered a negative correlation between health expenditure and mortality rate, suggesting that while life expectancy at birth responds favourably to changes in health expenditure, an increase in health expenditure causes a drop in death rate. In an updated study, Tatjana et al. (2023) looked at the relationship between government spending and health outcomes in Ghana. The study discovered that an increase in government health spending significantly increased life expectancy.

The effect of healthcare spending on specific health outcomes for 19 Middle Eastern and North African nations was examined by Akinci et al. (2023). The findings demonstrate that public and private healthcare investment greatly reduces newborn, under-five, and maternal mortality in the area. In order to determine if government involvement in the health sector improves outcomes, Boachie, Ramu, and Polajeva (2024) re-examined the relationship between government health spending and health outcomes. The results of the two-stage least squares (2SLS) and ordinary least squares (OLS) analyses demonstrated that, in addition to wealth, public health spending helped to enhance health outcomes in Ghana over that time. Overall, they discovered that a 10% increase in public health spending prevents 0.102–4. There are four newborn and under-five deaths for every 1000 live births, despite an annual increase in life expectancy at birth of 0.77–47 days.

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Onofrei, Vatamanu, Vintilă, and Cigu (2024) examined the connection between public health spending and health outcomes in developing EU nations. Through the use of regression analysis and factor analysis, they discovered that enhanced health care system performance and excellent governance status are directly related to health effectiveness and infant mortality reduction. Olayiwola, Adedokun, and Olusanya (2024) discovered that while government health spending decreased baby and maternal mortality rates, it increased life expectancy. Gwaison and Maimako (2024) investigated how Nigeria's health sector performed in relation to government health spending. The findings of the OLS estimation showed a positive but not statistically significant relationship between the life expectancy rate and government capital and recurring health expenditures. On the other hand, life expectancy was statistically significantly correlated with capital health spending.

The empirical literature as evidenced above shows that findings have remained inconclusive. This is because most existing studies used only public health expenditure as the sole measure of government intervention thereby neglecting other critical policy variables such as health insurance enrolment, health workforce density, and vaccination coverage. Again, forecasting health outcomes using historical data on government health expenditure per capita, including health insurance enrolment, health workforce density and vaccination coverage rate has received limited attention in empirical literature especially in Nigeria. This study fills these gaps identified.

3. METHODOLOGY

The study adopts the ex-post facto research design since the emphasis is on secondary time-series data. The data are sourced from World Bank Development Indicators, Central Bank of Nigeria Statistical Bulletin, National Health Insurance Agency and World Health Organization. The period covered is from 2000 to 2024 due to data availability for the years. Econometric procedures are adopted in analyzing the data which include the test for stationarity using the ADF unit root test, cointegration test and Error Correction Model (ECM). The ECM technique is preferred because it can be applied when variables are integrated of order one, $I(1)$, provided none is integrated of order zero $I(0)$ or order two, $I(2)$ (Pesaran, Shin & Smith, 2001).

Model Specification

The study is anchored on the Grossman health capital theory which sees investment in health as a driver of health capital stock and improved health outcomes. Consistent with this theory, government health interventions are disaggregated into public health expenditure per capita, health insurance enrolment rate, health workforce density and average vaccination coverage rate, while health outcomes is proxied with infant mortality, maternal mortality and life expectancy. In line with the specification of Olayiwola, Adedokun and Olusanya (2024), we specify three models by disaggregating public health intervention and relating them with the three health outcomes as follows:

$$MMR = f(PHP, HIE, HWD, AVC) \quad [1]$$

$$IMR = f(PHP, HIE, HWD, AVC) \quad [2]$$

$$LXP = f(PHP, HIE, HWD, AVC) \quad [3]$$

Where:

MMR = Maternal mortality rate

IMR = Infant mortality rate

LXP = Life expectancy at birth

PHP = Public health expenditure per capita

HIE = Health insurance enrolment rate

HWD = Health workforce density

AVC = Average vaccination coverage rate (DPT3, Measles and polio). The average vaccination coverage rate (AVC) is computed as:

$$\frac{DPT3 \text{ rate} + Measles \text{ rate} + Polio \text{ rate}}{3}$$

The relationship can be expressed in an econometric form as follows:

$$MMR_t = \alpha_0 + \alpha_1 PHP_t + \alpha_2 HIE_t + \alpha_3 HIE_t + \alpha_4 HWD_t + \alpha_5 AVC_t + \varepsilon_t \quad [4]$$

$$IMR_t = \beta_0 + \beta_1 PHP_t + \beta_2 HIE_t + \beta_3 HIE_t + \beta_4 HWD_t + \beta_5 AVC_t + \varepsilon_t \quad [4]$$

$$LXP_t = \gamma_0 + \gamma_1 PHP_t + \gamma_2 HIE_t + \gamma_3 HIE_t + \gamma_4 HWD_t + \gamma_5 AVC_t + \varepsilon_t \quad [4]$$

Where α_0 , β_0 and γ_0 are the intercepts of the three models, $\alpha_1 - \alpha_5$, $\beta_1 - \beta_5$, and $\gamma_1 - \gamma_5$ are the unknown coefficients of the three models to be estimated in the error correction model, ε_t is the error term in each model. The a-priori expectation is such that:

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$$\alpha_1 - \alpha_5 < 0,$$

$$\beta_1 - \beta_5 < 0,$$

$$\gamma_1 - \gamma_5 > 0.$$

That is to say that the public health intervention variables are expected to decrease maternal mortality rate as well as infant mortality rate. However, the public health intervention variables are expected to increase life expectancy at birth.

4. DATA ANALYSIS AND DISCUSSION

Stylized Facts on Government Health Interventions in Nigeria

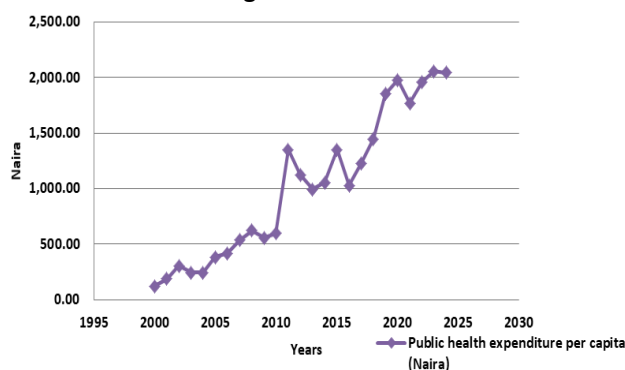


Figure 1: Government expenditure on health per capita, 2000-2024

Source: CBN Statistical Bulletin, 2024.

Government spending on health as seen in figure 1 increased from ₦120.41 per capita in 2000 to ₦2,044.53 per capita in 2024. The overall trend was upwards, but the series was quite volatile, meaning that there were some periods where the values rose sharply and other periods where they fell. There was a significant increase following 2010, indicating a greater commitment of government to financing health care.

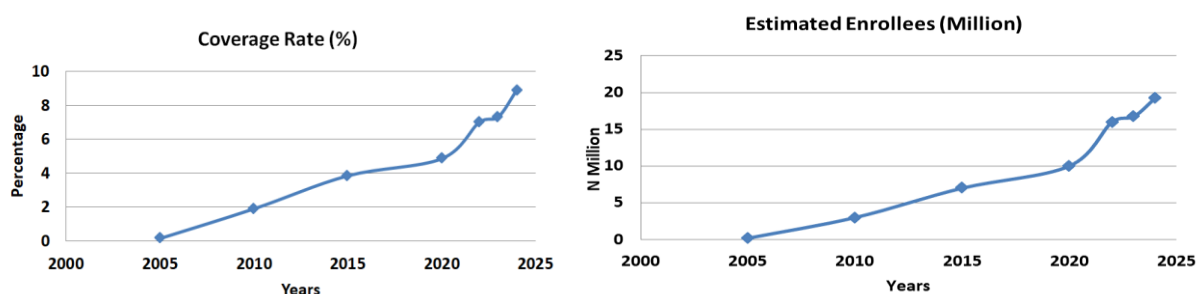


Figure 2: Annual health insurance enrollment rates (% of population) and estimated enrollees, 2000-2024.

Source: NHIS/NHIA published enrollment statistics and population estimates.

However, figure 2 shows that the proportion of people enrolled in health insurance during the initial years of the study period was very small, indicating that there is still a lack of insurance coverage in the country under the National Health Insurance Scheme. The percentage of enrolment rose slowly from 0.05 per cent (20million) in 2004 to 4.85 per cent (10million) in 2020 and then picked up speed since 2021. In 2024, 8.9 percent of the population (around 19.2 million) were enrolled in school. This is a significant improvement from the early years, but the level of coverage is still low, which means that a significant proportion of Nigerians are still out-of-pocket financing healthcare.

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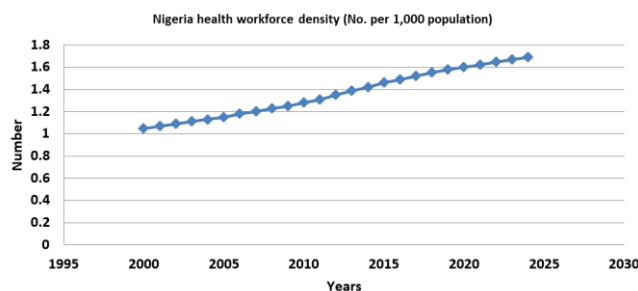


Figure 3: Nigeria health workforce density, 2000–2024 (Estimated health workforce density (physicians, nurses and midwives per 1,000 population).

Source: WHO, 2024

Figure 3 shows that the health workforce density (number of physicians, nurses and midwives per 1,000 population) has improved continuously during the period. In 2000, there was an average of 1.05 health workers per 1,000 persons, which rose to 1.69 in 2024. The upward trend indicates ongoing growth in the number of healthcare professionals being available. However, the density is still below the international recommended standards, suggesting there are continuing to be insufficient skillful healthcare workers and inequities between regions.

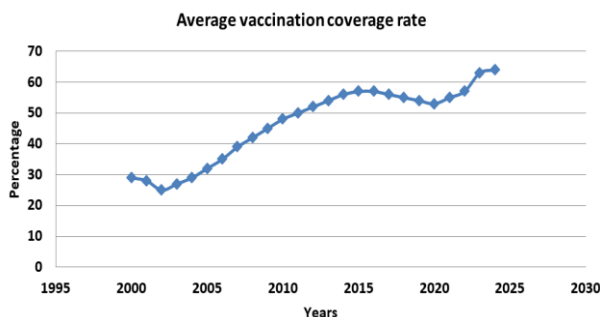


Figure 4: Nigeria average vaccination coverage rate, 2000–2024 (Average of DPT3, Measles MCV1, and Polio3 coverage rates)

Source: WHO/UNICEF 2024 estimates

There was also an overall upward trend in the average vaccination coverage rate in figure 4. The percentage of people covered grew from 29 percent in 2000 to 64 percent in 2024. The data also reveal a trend of steady growth from 32 percent to 57 percent of coverage from 2005 to 2015. Dips were seen from 2016 to 2020, but recovered well since 2021, with 2024 seeing the highest level.

The patterns offer some preliminary evidence that government investments in funding health care and other health care interventions can be important to improving health outcomes in Nigeria. This will, however, be empirically validated as will be shown in the following analyses.

Table 1: Summary of Unit Root Test

Variable(s)	ADF Test Statistics [<i>p-values</i>]		Decision	Order of Integration
	At Level	At 1 st Diff.		
MMR	-2.7244 [0.0859]	-5.2089 [0.0001]	Stationary at 1 st difference	I(1)
IMR	0.6748 [0.9887]	-8.7229 [0.0000]	Stationary at 1 st difference	I(1)
LXP	-0.7897 [0.8032]	-3.9319 [0.0349]	Stationary at 1 st difference	I(1)
PHP	-2.1700 [0.2214]	-5.5538 [0.0002]	Stationary at 1 st difference	I(1)
HIE	-1.0243 [0.7224]	-4.6982 [0.0016]	Stationary at 1 st difference	I(1)
HWD	-1.6678 [0.4329]	-7.8401 [0.0075]	Stationary at 1 st difference	I(1)
AVC	-2.1150 [0.2411]	-5.1109 [0.0226]	Stationary at 1 st difference	I(1)

Source: Extracted from E-views Output

Table 1 show that the variables are all stationary after first differencing and are said to be integrated of order I(1). What this implies for the study is that the data do not vary in the long run since they exhibited long run stability only when they are differenced. Thus, the data can be used for forecasting but only after differencing it first time. Consequently, the long run test can be ascertained using the Johansen cointegration test approach.

Table 2: Summary of the Johansen Cointegration Test

MMR				IMR				LXP			
No.	of	Trace	Prob.	No.	of	Trace	Prob.	No.	of	Trace	Prob.
CE(s)		Stat.		CE(s)		Stat.		CE(s)		Stat.	
None *		146.8459	0.0000	None *		100.7432	0.0000	None *		119.2829	0.0000
At most 1 *		70.84916	0.0001	At most 1 *		61.00820	0.0018	At most 1 *		75.40152	0.0000
At most 2 *		38.62055	0.0037	At most 2		29.74890	0.0506	At most 2 *		38.96177	0.0034
At most 3 *		15.92262	0.0431	At most 3		15.42199	0.0513	At most 3		13.31643	0.1037
At most 4		1.840390	0.1749	At most 4 *		7.019626	0.0081	At most 4		2.906679	0.0882

Source: Extracted from Eviews output

Table 2 summarizes the Trace statistics and their corresponding probability values which are used to test the null hypothesis of no cointegration against the alternative hypothesis of at least one cointegrating relationship in the models. For model one which is the maternal mortality model, there are at least four cointegrating equations signaling a stable long run relationship and rejection of the null hypothesis. In the second model (infant mortality model), the Trace statistic evidences two cointegrating equations while the third model (life expectancy model) shows three cointegrating equations. Thus, the Johansen cointegration results reveal that the variables included in the three models are cointegrated, indicating the existence of long-run equilibrium relationships between government health interventions and health outcomes in Nigeria.

Table 3: Error Correction Model Estimates

Model 1 (MMR)			Model 2 (IMR)		Model 3 (LXP)	
Variables	Coefficients	t-stat. (p-value)	Coefficients	t-stat. (p-value)	Coefficients	t-stat. (p-value)
C	5.378270	5.301634 (0.0001)	5.074356	7.103252 (0.0000)	4.012224	23.51535 (0.0000)
PHP	0.024001	0.468148 (0.6469)	0.017494	0.484570 (0.6355)	-0.003892	-0.451362 (0.6586)
HIE	-0.029251	-2.577635 (0.0179)	0.039653	1.096630 (0.2913)	0.010703	1.239358 (0.2356)
HWD	-0.551037	-2.408844 (0.0304)	-1.551056	-9.628625 (0.0000)	0.185469	4.820575 (0.0003)
AVC	0.425514	1.743496 (0.1032)	-0.104992	-0.610904 (0.5511)	-0.027388	-0.667227 (0.5155)
ECM(-1)	-1.368606	-3.254760 (0.0058)	-0.370413	-3.854133 (0.0215)	-0.237510	-3.358317 (0.0047)

Source: Extracted from Eviews output

The short-run ECM results are shown in Table 3. All coefficients of public health expenditure per capita (PHP) were found to be non-significant with respect to maternal mortality, infant mortality and life expectancy, thus not influencing these.

There is a significant negative association between enrolment in health insurance and maternal mortality ($\beta = -0.0293$, $p < 0.05$) which means that higher enrolment in health insurance is associated with lower mortality. But its impact on infant mortality as well as life expectancy are not statistically significant.

The health workforce density (HWD) is the most important determinant in the negative direction as it significantly reduces maternal mortality by 0.5510 ($p < 0.05$) and infant mortality by 1.5511 ($p < 0.01$) and in the positive direction it significantly increased life expectancy by 0.1855 ($p < 0.01$). This means that there is a possibility that health human resource availability could be very important in enhancing health outcomes in Nigeria.

The average vaccination coverage (AVC) shows the negative expected relationship with infant mortality but the coefficients are not statistically significant in the different models, meaning that AVC has a weak short run impact on the widened health outcomes.

When the error correction terms (ECM(-1)) have negative significant value in all three models, it was established that there exists long-run relationships between the variables. These coefficients show that there are annual adjustments of 136.9%, 37.0%, and 23.8% for maternal mortality, infant mortality, and life expectancy, respectively, considered as deviations from long run equilibrium.

Test of Hypotheses

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Hypothesis One:

H₀₁: Public health expenditure per capita has no significant effect on maternal mortality, infant mortality and life expectancy in Nigeria.

The results show that public health expenditure per capita has insignificant effects on maternal mortality ($p = 0.6469$), infant mortality ($p = 0.6355$), and life expectancy ($p = 0.6586$). Since the p -values are greater than 0.05, the null hypothesis is accepted. Therefore, public health expenditure per capita has no significant effect on maternal mortality, infant mortality, and life expectancy in Nigeria.

Hypothesis Two:

H₀₂: health insurance enrolment rate has no significant effect on maternal mortality, infant mortality and life expectancy in Nigeria.

The results indicate that health insurance enrolment rate has a significant effect on maternal mortality ($p = 0.0179 < 0.05$) but insignificant effects on infant mortality ($p = 0.2913$) and life expectancy ($p = 0.2356$). Therefore, the null hypothesis is partially rejected. Health insurance enrolment significantly affects maternal mortality but has no significant effect on infant mortality and life expectancy in Nigeria.

Hypothesis Three:

H₀₃: There is no significant effect of health workforce density on maternal mortality, infant mortality and life expectancy in Nigeria.

The findings reveal that health workforce density significantly affects maternal mortality ($p = 0.0304$), infant mortality ($p = 0.0000$), and life expectancy ($p = 0.0003$). Since all p -values are less than 0.05, the null hypothesis is rejected. Therefore, health workforce density has a significant effect on maternal mortality, infant mortality, and life expectancy in Nigeria.

Hypothesis Four:

H₀₄: Average DPT3, measles, polio vaccination coverage rate has no significant effect on maternal mortality, infant mortality and life expectancy in Nigeria.

The results show that average vaccination coverage has insignificant effects on maternal mortality ($p = 0.1032$), infant mortality ($p = 0.5511$), and life expectancy ($p = 0.5155$). Since all p -values exceed 0.05, the null hypothesis is accepted. Thus, average DPT3, measles, and polio vaccination coverage rate has no significant effect on maternal mortality, infant mortality, and life expectancy in Nigeria.

DISCUSSION OF FINDINGS

The results indicated that, maternal mortality, infant mortality, and life expectancy in Nigeria were not significantly related to public health expenditure per capita. This finding indicates that the extra government funding for health has not been properly spent on improved health outcomes. The results align with the works of Azuh et al. (2020) and of Adewumi, Acca and Afolayan (2021), which both showed that public health spending was positively associated with mortality outcomes in Nigeria, which implies inefficiencies in health resource utilisation. But this contradicted Bokhari, Gai and Gottret (2007), Edeme, Emecheta and Omeje (2021), Awoyemi et al. (2023) and Olayiwola, Adedokun and Olusanya (2024) who reported that public health spending significantly lowered mortality rate and improved life expectancy. It is common to think that the problem with health spending in Nigeria is that it is too much, but this may not be the case as it could be too ineffective, not transparent, or not efficient in terms of allocating and using health resources.

Another finding from the study was that there was a significant decrease in maternal mortality when people were enrolled in health insurance, while there was no significant impact on infant mortality or life expectancy. This is in accord with the proposition of Akintunde, Adesine and Akinrinde (2022) who found out that improving health financing mechanisms accelerates health outcomes when access to healthcare services is improved. It is likely that the additional reduction in maternal deaths is related to better ANC, delivery, and PNC utilization of insured women. But the lack of health gain at the national level, as reflected in the mortality rate and life expectancy, indicates that insurance coverage is still too low to produce wider social benefits on health. Better maternal health coverage under the National Health Insurance Authority (NHIA) may bring better health outcomes in Nigeria that would result from an expansion of coverage.

The results further suggest that density of the health workforce is significantly correlated with improving the reduced maternal mortality, reduced infant mortality, and increased life expectancy. This finding is consistent with the Health Capital Theory that posits that access to healthcare services can help to increase the supply of health capital. This is in line with Campbell et al.'s (2013) findings that having a skilled healthcare worker available is a key determinant of health outcomes. The piece of news suggests that health sector adequately resourcing the health workforce in terms of both quality and quantity could significantly reduce

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population level outcomes in Nigeria. Increase investment in health worker development is essential given the endemic shortage and migration of health workers.

In addition, average vaccination coverage rate (DPT3, measles, polio), was not significantly associated with maternal mortality, infant mortality, and life expectancy. This is in contrast to the results reported by Obisike, Iwuchukwu, and Unegbu (2021), which showed that immunization programmes had a positive role in the health of the population in Nigeria. It also contrasts with the findings by the Health Capital Theory, which saw immunization programmes as having a negative role in health outcomes. This small impact could be due to differences in vaccination coverage between regions, lack of uptake of vaccination, and problems with vaccines when accessing the health service. However, vaccination is also regarded as an important public health measure and its contribution to global health outcome might be limited by level of equity and coverage in immunization services delivery in Nigeria.

5. CONCLUSION AND RECOMMENDATIONS

The research on the effect of government health interventions on the health outcomes in Nigeria has mixed conclusion. Specifically, per capita public health expenditure was shown to have no significant impact on maternal mortality, infant mortality and life expectancy, nor was it significantly associated with average vaccination coverage rate (DPT3, measles, polio). This indicates that simply increasing on health expenditure or coverage may not improve health status, because of, among other reasons, implementation issues, inefficiencies and inequities in access to health care. The study also shows that achievement of health insurance coverage has significant impact on maternal mortality, but not infant mortality and life expectancy. This essentially means that the increase of health insurance coverage could help maternal health only through increasing access to health services. The key government health intervention that had the greatest effect on maternal mortality, infant mortality and life expectancy was health workforce density. This implies that the presence of skilled healthcare workers in Nigeria was most effective government health intervention that improved health outcomes. In light of the study results the following recommendations are made:

1. Government must intensify monitoring, evaluation and transparency systems for ensuring the optimum use of allocated health funds for health care provision and investments in healthcare infrastructure, having found that health expenditure per capita had no significant effect on health outcomes.
2. It is important that the government should enhance ongoing efforts to enroll vulnerable groups and low income groups, and more generally to expand enrolment with the National Health Insurance Authority (NHIA), to increase access to essential maternal healthcare services given the fact that health insurance had significant effect on maternal mortality.
3. Government should invest more in recruitment, training and retention of all health workers, especially for recruitment and RT/ retention of physicians, nurses and midwives as they play a key role in improving all the health indicators; anticipate challenges with brain drain to health workers by improving the working conditions, remuneration and career development for health workers.
4. While the results indicate that vaccination coverage does not significantly influence health outcomes, it is suggested that vaccination coverage be boosted by an increase in the accessibility of vaccines, community sensitization, and coverage in underserved areas to gain the most out of immunization programmes. Furthermore, government needs to be able to provide equitable access between urban and rural areas to the healthcare facilities, staff and healthcare interventions to the people to reduce regional variations in health outcomes.

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