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Health Intervention Intensity in Nigeria: Implications for Maternal Mortality, Infant Mortality and Life Expectancy

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ABSTRACT: This study investigates health intervention intensity in Nigeria and its implications for maternal mortality, infant mortality and life expectancy. Existing studies have largely focused on the direct relationship between health expenditure and health outcomes without considering health intervention intensity as a single variable to measure government, private and foreign/donor health interventions. The main objective of this study is to determine the causal relationship between health intervention intensity, maternal mortality, infant mortality and life expectancy in Nigeria for the period 1990 to 2024. Data on health intervention intensity is obtained using a weighted composite index which is standardized to fall between 0 and 1. The study adopts a quantitative research design based on secondary time-series data sourced from World Bank Development Indicators, Central Bank of Nigeria Statistical Bulletin and World Health Organization, as well as relevant donor health financing databases. Toda-Yamamoto causality approach is used to examine the direction of causality among variables. The results indicate that health intervention intensity has significant causal relationship with maternal mortality and life expectancy in Nigeria, but not infant mortality. The conclusion is that although health interventions in Nigeria are effective in enhancing long-term survival and maternal outcomes, their effect on infant health is minimal, perhaps because of inefficiencies in neonatal care delivery or slow effects of interventions. The study recommends coordinated financing strategy across public, private and donor sources, strengthening of neonatal and child health systems, and sustaining and expansion of integrated health investments across public, private and donor-supported programmes.

KEYWORDS: health intervention intensity, health outcomes, infant mortality, life expectancy, maternal mortality, Toda-Yamamoto

1. INTRODUCTION

Health outcomes in Nigeria remain a strategic concern for development over the last three to four decades with particular emphasis on maternal mortality, infant mortality and life expectancy. Since 1990, Nigeria has remained consistent in recording high mortality rates despite the fact that efforts have been made by both government and private sector to ensure health sector reforms (Meh, Thind, Ryan, & Terry, 2019). For instance, Nigeria recorded maternal mortality of over 1,200 deaths per 100,000 live births in the early 1990s but this declined to about 993 per 100,000 live births by the end of 2023 (World Bank, 2023). However, the current statistics remains one of the highest in the world according to World Bank (2023) and World Health Organization [WHO] (2023). Similarly, infant mortality declined from over 100 deaths per 1,000 live births in 1990 to approximately 60 deaths per 1,000 live births as at last quarter of 2023 (United Nations Children's Fund [UNICEF], 2023). Nigeria has achieved relative improvement in life expectancy rising modelty from about 46 years in 1990 to roughly 54 to 56 years in the last quarter of 2023 (United Nations Development Programme [UNDP], 2023). These trends in these selected health outcomes imply that progress has been made given the intensity of interventions in the health sector.

Coming to health intervention intensity, the Nigerian government has received interventions from international and private sector actors over the last few years (World Bank, 2023). Government-led interventions include the expansion of primary health care services, introduction of the National Health Insurance Scheme, implementation of programmes such as Midwives Service Scheme, Saving One Million Lives programme, etc. (Akinyemi & Adebayo, 2024; Abimbola et al., 2023). With these interventions, public health expenditure has risen in nominal terms averaging 3% to 5% of total annual government expenditure in 2022 and 2023 respectively (Central Bank of Nigeria [CBN], 2024. However, Okafor and Elu (2021) observed that this percentage has remained low when compared with total government spending, given the 15% target set by the Abuja declaration.

Additionally, donor agencies and private organization have contributed funds towards immunization, maternal and child health, malaria control and strengthening of the health systems in Nigeria (World Health Organization [WHO], 2023; World Bank, 2023). For example, agencies such as the Bill & Melinda Gates Foundation, Global Fund and Gavi have collectively committed and disbursed billions of US dollars to Nigeria since the early 2000s (Institute for Health Metrics and Evaluation [IHME], 2023). The Global Fund alone has spent over $4 billion in Nigeria to aid programmes targeted at reducing HIV/AIDS, tuberculosis and malaria (United Nations Programme on HIV/AIDS [UNAIDS], 2023). Gavi has provided over $1 billion in funding for immunization programmes, thus, improving vaccine coverage in Nigeria (Global Fund, 2023; Gavi, 2023). Similarly, the Belinda & Gates Foundation has invested roughly $1.16 billion over the last decade in Nigeria on immunization, maternal and child health, as well as disease control (Gates Foundation, 2023). Health intervention intensity increased after the covid-19 pandemic with more private sector actors rendering interventions in one aspect of health sector or the other. These combined efforts reflect the growing health intervention intensity in Nigeria measured in terms of funding, scope of the programme, and institutional involvement (Aregbeshola & Khan, 2018).

Statistics reveal that Nigeria's health intervention intensity has been on the increase but it appears that health outcomes (maternal mortality, infant mortality and life expectancy) have not improved proportionate to the intensity of health interventions. Nigeria's maternal mortality (993 per 100,000 live births) is significantly higher than the average for lower-middle income countries which is 400 per 100,000 live births (World Bank, 2023). Similarly, infant mortality for Nigeria which is estimated at 28 per 1,000 live births exceeds the global average of 28 per 1,000 live births, while life expectancy still lags behind at 54 – 56 years compared to 65 years in many comparable developing countries (World Bank, 2023; World Health Organization [WHO], 2023). This disproportionate relationship raises the concern about policies formulation that can drive improved health outcomes in Nigeria. It is important to note that without effective forecast, policy formulations will be difficult and so this study comes in handy at this time when Nigeria desires effective direction that will improve health outcomes in the face of growing intensity of health interventions.

Again, existing studies have largely focused on the direct relationship between health expenditure and health outcomes without considering health intervention intensity as a single variable to measure government, private and foreign/donor health interventions (Ogunjimi & Adebayo, 2019; Olayiwola, Adedokun, & Olusanya, 2021; Udeorah, Asuzu-Samuel, & Amadi, 2024; Nnamdi & Ngwu, 2025; Lawal, Balogun, & Fagbohun, 2025). Since health intervention intensity quantifies the scale of resources committed to improving health outcomes relative to resulting impact, the composite measure incorporates public expenditure, donor funding, private healthcare investments, programme coverage and service delivery expansion as a single index (Anselmi, Lagarde, & Hanson, 2015; WHO, 2024). Thus, by integrating these dimensions into a single analytical framework, health intervention intensity provides a comprehensive and realistic measure of the effectiveness of health investments.

The problems stated above culminate into achieving the main objective of this study. Thus, the main objective is to determine the causal relationship between health intervention intensity, maternal mortality, infant mortality and life expectancy in Nigeria for the period 1990 to 2024. The specific objectives of the study are to:

1. examine the causal relationship between health intervention intensity and maternal mortality in Nigeria;
2. investigate the causal relationship between health intervention intensity and infant mortality in Nigeria;
3. ascertain the causal relationship between health intervention intensity and life expectancy in Nigeria.

These specific objectives are transformed into research hypotheses for the purpose of empirical validation:

H_{01}: There is no significant causal relationship between health intervention intensity and maternal mortality in Nigeria.

H_{02}: There is no significant causal relationship between health intervention intensity and infant mortality in Nigeria.

H_{03}: There is no significant causal relationship between health intervention intensity and life expectancy in Nigeria.

2. LITERATURE REVIEW

The Grossman health demand model and the health production function framework are two theories that sits well with this study. The Grossman health demand model was developed by Michael Grossman in 1972 and it forms part of the theories that forms modern health economics. The theory states that investments in health capital coupled with efficiency in its utilization produce better health outcomes (Grossman, 1972). Thus, the theory sees health as a durable capital stock that individuals and societies invest in order to derive utility from. Health is demanded because it enhances productivity and not just because it provides direct satisfaction (Grossman, 1972). On the other hand, the health production theory is a modified traditional production theory which states that health outcomes are determined by the quantity and quality of inputs used in the healthcare system (Auster, Leveson, & Sarachek, 1969; Grossman, 1972). The level of inputs coupled with institutional and environmental factors are what influences health outcomes in the health production function theory (Anyanwu & Erhijakpor, 2007; Nixon & Ulmann, 2006).

In direct relationship with this study, these two theories emphasize the fact that increased government and private sector investments in health care should increase health intervention intensity which should also translate into improved health outcomes. However, the current high rates of maternal and infant mortality, and the decreasing life expectancy in Nigeria despite what appears to be increased interventions goes a long way to imply inefficiencies in the health system. Thus, there is perceived inefficiency in the utilization of these health intervention funds which explains the fact that despite increase in health intervention intensity in Nigeria, there is still low health outcomes. From the second theory's perspective (health production function), health intervention intensity acts as the composite input variable that directly affects the output variable (health outcomes). Thus, the two theories are complementary in the sense that health intervention can only result to better health outcomes when the interventions and efficient and effectively utilized. Therefore, the relevance of this theory is tested in this study using data from Nigeria.

Empirically, several studies have linked health intervention (mostly government health intervention) to health outcomes (maternal and infant mortality, life expectancy) both in Nigeria and outside of Nigeria. Ogunjimi and Adebayo (2019) studied health expenditure and health outcomes and economic growth in Nigeria. They found that health expenditure positively affects health outcomes (mortality and life expectancy), but the effect was weak. Olayiwola, Adedokun and Olusanya (2021) found that public health spending significantly affects infant and maternal mortality but the magnitude of impact remains limited.

Akintunde et al (2023) examined healthcare expenditure and its effect on maternal mortality in Nigeria. Using ARDL technique, they found that health expenditure reduces maternal mortality significantly due to the unsustainable nature of the funding. Udeorah, Asuzu-Samuel and Amadi (2024) used a mixed analytical approach to study the effectiveness of healthcare expenditure in reducing maternal mortality in Nigeria. They found that the effect of public and private health on maternal deaths is uneven and highly dependent on access to quality healthcare services and infrastructure. Babwulle (2024) studied the effect of health care expenditure on infant mortality using the ordinary least square regression technique. The result revealed that increased health expenditure significantly reduces infant mortality. Similar study was conducted by Paul and Agada (2024) where-in they linked health expenditure to life expectancy. They found a long run relationship between health expenditure and life expectancy but found non-causality between the two variables.

Lawal, Balogun and Fagbohun (2025) in their study on public health expenditure, institutional quality and health outcomes used ARDL estimation technique and found that health expenditure improved life expectancy but reduces mortality rates. The study also found that the effectiveness of health expenditure on maternal mortality rate is dependent on institutional quality. Yaji, Mihalyi and Williams-Yaji (2026) provided recent evidence using ARDL framework. They found weak causal relationship between public health expenditure and infant mortality. A study by Viswanathan et al (2024) on intensity and potential for causal inference in social needs interventions used scoping review and found that overall interventions are multi-component and intensive but are rarely designed to affect specific health outcome.

From a micro level, Steal et al (2012) examined the effectiveness of nicotine replacement therapy. Using randomized control therapy, they found that higher intervention intensity in this area (sustained dosage, behavioral support) increased the likelihood of quitting smoking significantly. Cahil et al (2013) found that intensive treatment combinations produced better cessation outcomes compared to single-intervention approaches. Banerjee et al (2015) demonstrated that increased microfinance programme exposure and intensity influenced household welfare outcomes. Also, Hoddinott et al. (2013) found that nutrition-focused intervention intensity especially for early childhood significantly improved long term health outcomes.

The main gap identified from the literature review is the absence of a composite measure for health intervention at the macro level. Some studies have used intervention intensity as a variable at the micro-level on specific interventions such as smoking cessation (Stead et al., 2012; Cahill et al., 2013), social programmes (Hoddinott et al, 2013; Banerjee et al., 2015), none of the previous studies have tried to compute the macro-level data for health intervention intensity. This implies that the concept of health intervention intensity is recognized in health economics literature but not standardized or aggregated at the macro (country) level. Also, studies linking this variable to any of or a combination of the health outcomes (maternal, infant mortality and life expectancy) are scare.

3. METHODOLOGY

The study adopts a quantitative research design based on secondary time-series data sourced from World Bank Development Indicators, Central Bank of Nigeria Statistical Bulletin and World Health Organization, as well as relevant donor health financing databases. The period covered is from 1990 to 2024. Prior to estimation of the model, the variables are tested for stationarity using the ADF unit root test. The descriptive statistics are also shown in order to confirm the suitability of the data. The study employs the Toda-Yamamoto causality approach to examine the direction of causality among variables without requiring pre-testing for cointegration, making it suitable for mixed-order integrated series.

Model Specification

Building on the Grossman health demand model and the health production function framework, this study posits that health intervention intensity contributes potentially to improving maternal, child health capital, and life expectancy. The relationship can be expressed as:

$H_t = I_t - \delta H_{t-1} + \mu_t$ [1]

Where H_t denotes the health capital at time t, I_t is health intervention and δ is the natural rate of health capital depreciation. Given that maternal mortality and child mortality are inverse functions of health capital (i.e., higher H_t implies lower MMR_t and IMR_t), we can express the reduced form empirically as:

$MMR_t = f(HII_t)$ [2]

$IMR_t = f(HII_t)$ [3]

Since health capital is a product of health intervention intensity, it follows that $H_t = I_t$ where I_t is health intervention intensity renamed as HII_t.

Also, life expectancy is a positive function of health capital reflecting the cumulative long run effect of improved survival conditions and reduced mortality risks over time, we model as follows:

$LXP = f(MMR, IMR, HII_t)$ [4]

Where:

MMR_t = Maternal mortality rate,

IMR = Infant mortality rate

LXP = Life expectancy at birth

HII_t = Health intervention intensity

The general augmented causality model is expressed as follows:

$$Y_t = \propto_0 + \sum_{i=1}^{k} \propto_i Y_{t-i} + \sum_{j=1}^{d_{max}} \beta_j Y_{t-j} + \varepsilon_t \quad [5]$$

And the system of equations can be represented as follows:

$$MMR_t = \propto_0 + \sum_{i=1}^{k} \propto_{1i} HII_{t-i} + \varepsilon_{1t} \quad [6]$$

$$IMR_t = \mu_0 + \sum_{i=1}^{k} \mu_{1i} HII_{t-i} + \varepsilon_{2t} \quad [7]$$

$$LXP_t = \delta_0 + \sum_{i=1}^{k} \delta_{1i} MMR_{t-i} + \sum_{i=1}^{k} \omega_{1i} IMR_{t-i} + \sum_{i=1}^{k} \gamma_{1i} HII_{t-i} + \varepsilon_{3t} \quad [8]$$

The null hypothesis H_0: $\beta_{1i} = 0$ (for all *i*) tests whether health intervention intensity do not Granger-cause maternal mortality, infant mortality and life expectancy. The Grossman theory predicts that effective health intervention intensity, i.e. investment in health capital will cause lower maternal and child mortality as well as improve life expectancy in the long term.

Derivation of health intervention intensity index:

Health Intervention Intensity Index is specified as a weighted composite index capturing the magnitude of government and donor spending on targeted disease programs, and is standardized to fall between 0 and 1. The index is comprised of five components namely public health expenditure, donor funding, private health expenditure, health programme coverage (immunization and antenatal care coverage %), and health service delivery capacity (doctors per 1,000 people). Since the variables are in different units, we standardize them by taking the following step:

$$X_{it}^{*} = \frac{X_{it} - X_i^{min}}{X_i^{max} - X_i^{min}}$$

Under the equal-weighting approach, each component of health intervention intensity is assigned an identical weight, implying that all intervention sources contribute equally to health outcomes. Thus, the weight for each variable is:

$$w_i = \frac{1}{5}$$

The Health Intervention Intensity Index (HII) is therefore specified as follows:

$$HII_t = \frac{1}{5}(ghe_t^{*} + dhf_t^{*} + phe_t^{*} + hpc_t^{*} + hsd_t^{*}$$

Where $ghe_t^{*}, dhf_t^{*}, phe_t^{*}, hpc_t^{*}, and\ hsd_t^{*}$ are normalized government health expenditure, donor funding, private health expenditure, health programme coverage and health service delivery capacity respectively. The equal-weight approach is adopted

due to its simplicity, transparency, and wide application in composite index construction, particularly when theoretical basis for assigning differential weights is not available.

4. DATA ANALYSIS AND DISCUSSION

Table 1: Summary of the Descriptive Statistics

	MMR	IMR	LXP	HII
Mean	1126.043	87.33143	49.74857	0.401429
Median	1124.000	89.20000	50.40000	0.390000
Maximum	1285.000	120.4000	55.00000	0.670000
Minimum	968.5000	54.60000	45.50000	0.210000
Std. Dev.	72.91114	20.06041	3.072111	0.138991
Skewness	0.139211	0.017916	-0.065272	0.332586
Kurtosis	2.937004	1.791258	1.612734	1.948437
Jarque-Bera	0.118836	2.132580	2.831424	2.257846
Probability	0.942313	0.344283	0.242753	0.323381
Observations	35	35	35	35

Source: Extracted from Eviews 9 Output

The descriptive statistics indicate that the average maternal mortality rate (MMR) is about 1126 deaths per 100,000 live births, and infant mortality rate (IMR) is about 87 deaths per 1,000 live births, which indicates the continuity of high child and maternal health risks in Nigeria over the period of study. Life expectancy (LXP) is approximately 49.75 years old and the survival outcomes are generally low, even though there have been improvements over time. The average value of the Health Intervention Intensity Index (HII) is 0.40 indicating a moderate degree of government, private and donor-sourced combined health interventions.

The values of the standard deviation indicate that MMR and IMR are not very variable, whereas HII is comparatively low (0.14), meaning that the intensity of intervention has been growing steadily, but not with sharp peaks. Life expectancy has the least variation implying gradual yet gradual improvement over time. The skewness values are all nearly symmetrically distributed and LXP is slightly skewed to the negative whereas MMR and HII are slightly skewed to the positive. All the values of kurtosis are less than 3 (with exception of MMR which is approaching normal distribution), thus distributions are close to normal curve.

The Jarque-Bra probabilities of all variables are above 0.05, which means that none of the variables have significantly different normality. This validates the fact that the data is normally distributed and can be analyzed in terms of time-series econometric models like the Toda-Yamamoto causality model.

Table 2: Summary of Unit Root Test

Variable(s)	ADF Test Statistics			Order Of Integration
	At Level	At 1st Diff.	Decision	
MMR	-0.6432 [0.8469]	-6.7645* [0.0000]	Stationary at 1st difference	I(1)
LXP	-0.3551 [0.9056]	-3.4474* [0.0162]	Stationary at 1st difference	I(1)
IMR	1.3257 [0.9982]	-9.6587* [0.0000]	Stationary at 1st difference	I(1)
FHI	-0.7357 [0.8238]	-8.5669* [0.0000]	Stationary at 1st difference	I(1)

Source: *Extracted from E-views 9 Output (See Appendix)*

Table 2 reveals that all the variables are stationary at first difference. Thus, they are said to be integrated at order I(1). Therefore, the maximum order of integration for the Toda Yamamoto causality analysis is one, i.e. $d_{max} = 1$.

The lag length criteria used for this study is the Akaike Information Criterion (AIC). The AIC shows that the three models have maximum of 2 lag lengths based on the AIC criterion. Thus, the models have lag orders of 2 meaning that k = 2.

Estimation of the Toda-Yamamoto Causality Test

Earlier, from the unit root test, the maximum order of integration is one meaning that $d_{max} = 1$. Also, the three models have 2 lag lengths meaning that k = 2. Thus, the Toda-Yamamoto causality test is estimated by adding the maximum integration order to the maximum lag length as follows:

$k + d_{max} = 2 + 1 = 3$

The Toda-Yamamoto causality result is summarized in Table 3 below:

Table 3: Toda-Yamamoto Chi-Sq. (*p-values*)

Model 1			**Model 2**			**Model 3**		
Variables	**MMR**	**HII**	**Variables**	**IMR**	**HII**	**Variables**	**LXP**	**HII**
MMR	--	0.1562 (0.9249)	**IMR**	--	2.1831 (0.3357)	**LXP**	--	1.7102 (0.4252)
HII	4.9195 (0.0455)	--	**HII**	2.6113 (0.2710)	**--**	**HII**	4.1395 (0.0262)	--

Source: Extracted from Eviews 9 output

The results from Table 3 show the following:

In the case of Model 1 (MMR and HII), the outcome shows that there is a unidirectional causality between health intervention intensity (HII) and the maternal mortality (MMR). This is supported by a Chi-square value that is statistically significant of 4.9195 (*p-value* = 0.0455), which is lower than the 5% level of significance. This means that health intervention intensity changes are highly predictive of maternal mortality in Nigeria. The causality between MMR and HII is however not significant in the reverse (*p-value* = 0.9249) meaning that maternal mortality has no effect on the magnitude of health intervention intensity.

The findings of the Model 2 (IMR and HII) indicate no statistically significant causal relationship in both directions. HII has an insignificant effect on IMR (*p-value* = 0.2710) and IMR is not Granger-caused by HII (*p-value* = 0.3357). This implies that the health intervention intensity change did not directly have causal relationship with infant mortality over the study period, perhaps because of implementation inefficiencies or a lagged effect which is not modeled.

In Model 3 (LXP and HII), the results indicate that there is a strong unidirectional causality between the intensity of health intervention and life expectancy with Chi-square = 4.1395 (*p-value* = 0.0262). This means that escalations in the intensity of health interventions make a lot of contribution towards the improvement of life expectancy in Nigeria. On the other hand, the life expectancy does not play a significant role in bringing changes in the intensity of health interventions (*p-value* = 0.4252).

Test of Hypotheses

H_{01}: There is no significant causal relationship between health intervention intensity and maternal mortality in Nigeria.
The result shows a significant unidirectional causality from HII to MMR (*p-value* = 0.0455 < 0.05). The hypothesis concludes that health intervention intensity significantly causes changes in maternal mortality in Nigeria.

H_{02}: There is no significant causal relationship between health intervention intensity and infant mortality in Nigeria.
The causality test shows no significant relationship between HII and IMR (*p-value* = 0.2710 and 0.3357 > 0.05). The conclusion is that there is no significant causal relationship between health intervention intensity and infant mortality in Nigeria.

H_{03}: There is no significant causal relationship between health intervention intensity and life expectancy in Nigeria.

The result indicates a significant unidirectional causality from HII to life expectancy (*p-value* = 0.0262 < 0.05). This third hypothesis concludes that health intervention intensity significantly influences life expectancy in Nigeria.

DISCUSSION OF FINDINGS

The study found that the intensity of health interventions has significant causal relationship with maternal mortality which is consistent with theoretical predictions that the greater the investment in health capital, the better the survival chances (Grossman, 1972). The finding indicates that aggregate interventions, such as government spending, donor aid, and private investment and expansion of services delivery play a significant role in saving maternal deaths in Nigeria. This aligns with the results of Akintunde et al. (2023), who indicated that the healthcare spending is a major factor in decreasing maternal mortality, which was applied through an ARDL method. Likewise, Olayiwola, Adedokun, and Olusanya (2021) established that public health spending significantly impacts maternal health outcomes, but the magnitude is low.

The relationship in this study, however, is stronger because of the composite nature of HII, which simultaneously covers many funding streams and programmes. This substantiates the argument that health spending causes health outcomes to be more responsive to the institutional and structural conditions as presented by Lawal, Balogun and Fagbohun (2025). Maternal mortality, therefore, seems to emerge as the most sensitive outcome to aggregated health intervention initiatives, especially since it is highly sensitive to antenatal care, skilled attendance during birth, and emergency obstetric care - all of which health intervention programmes in Nigeria are specifically aimed at.

Conversely, the lack of a substantial causal relationship between HII and infant mortality is aligned with a number of empirical findings that underscore weak or incongruent impacts of health spending on child survival outcomes in Nigeria. An example is the work of Yaji, Mihalyi, and Williams-Yaji (2026) who observed weak causal links between infant mortality and public health spending, indicating that funding is not easily converted to better neonatal performance. Likewise, Udeorah, Asuzu-Samuel, and Amadi (2024) found that the impact of health spending on child and maternal health greatly relies on the quality of healthcare infrastructure and equity in regions. This result is also in line with Babawulle (2024), who noted that health expenditure on infant mortality has significant but disproportionate impact, which means that structural bottlenecks restrict the flow of financial resources into better outcomes.

Theoretically, health production function indicates that the outputs of inputs are not only determined by inputs but also their efficiency and quality of combination (Auster, Leveson, and Sarachek, 1969; Nixon and Ulmann, 2006). Thus, the negligible outcome on IMR can be an indicator of inefficiencies in the delivery of neonatal care, imperfect primary healthcare, and rural accessibility, where infant deaths are the most common.

Furthermore, the significant causal relationship between the health intervention intensity and life expectancy is in line with theoretical and empirical literature. In the Grossman model, life expectancy is a cumulative measure of better chances of survival as one ages. Therefore, long-term health intervention increases are likely to improve life span. Empirically, Ogunjimi and Adebayo (2019) and Paul and Agada (2024) have discovered long-run causation between health expenditure and life expectancy, but Paul and Agada (2024) have indicated the lack of causation in a short-run. Likewise, Lawal, Balogun and Fagbohun (2025) found out that health spending increases life expectancy especially with a high quality of institutions. The greater impact in this study could be explained by the fact that HII was measured more broadly, including such factors as expenditure, as well as service delivery and programme coverage. The finding is also consistent with Hoddinott et al. (2013), who revealed that long-term health-related intervention leads to long-term effects on population well-being. This indicates that life expectancy is more sensitive to cumulative and sustained interventions and not the changes in expenditure in the short term.

5. CONCLUSION AND RECOMMENDATIONS

The study concludes that health intervention intensity has significant causal relationship with maternal mortality and life expectancy in Nigeria, but not infant mortality. This indicates that, although health interventions in Nigeria are effective in enhancing long-term survival and maternal outcomes, their effect on infant health is minimal, perhaps because of inefficiencies in neonatal care delivery or slow effects of interventions. Given the findings and conclusion drawn there-from, the study recommends as follows:

1. The Nigerian government should sustain and further strengthen coordinated financing across public, private and donor sources. The strategies recommended include improved budget allocation, timely release of funds, and effective collaboration with donor agencies. This coordinated strategy will further enhance the direct impact on maternal health and have over-spilling effect on other health outcomes in the long run when it is sustained.
2. Urgent attention should be directed towards the strengthening of neonatal and child health systems since health intervention had no significant causal relationship with infant mortality rate. Government should ensure that health interventions prioritize skilled birth attendance, emergency neonatal care, immunization coverage and improvement in overall child health service delivery.
3. Since health intervention intensity significantly influences life expectancy in Nigeria, government should sustain and expand integrated health investments across public, private and donor-supported programmes. Resources should be particularly allocated to interventions that promote long-term population health in order to further enhance life expectancy in Nigeria.

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