

Macro-Level Health Financing Trends and Household Financial Catastrophe in Nigeria: A Multi-Method Analysis of Institutional Reforms, 2000-2023

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Abstract Safety monitoring in family planning (FP) and post-abortion care (PAC) services in low- and middle-income countries (LMICs) relies on safety flags and incident rates, yet these indicators are rarely interpreted together. This creates a risk that incident rate differences between service delivery channels may be misread as quality deficits when they reflect differences in service scope and case complexity. This study examined safety flags, incident rates, and quality assessment performance in an integrated framework across centre-based facilities and outreach teams in a Sierra Leone FP/PAC programme. A longitudinal observational analysis used 108 Quality Technical Assessment (QTA) records from 23 paired service delivery points across 14 districts (2019–2022). Safety flags and safety domain scores were compared between remote and in-person assessment modalities using chi-square and Mann-Whitney U tests. Clinical and product incident rates per 1,000 couple-years of protection (CYP) were compared between channels. Domain-specific QTA scores were compared across eight quality domains. Safety flags did not differ significantly between modalities ($p = .740$). Centre-based facilities showed significantly higher incident rates than outreach services ($U = 0.00$, $Z = -2.309$, $p = .021$, $r = -0.82$). Despite this, no significant channel differences were observed in composite QTA final scores ($p = .448$) or in any of the eight quality domains. The divergence between higher incident rates at centres and equivalent quality scores indicates the difference reflects structural differences in service scope and case complexity rather than quality deficits. These findings support integrated safety frameworks in reproductive health programme monitoring.

Keywords Incident Rates, Integrated Analysis, Post-Abortion Care, Quality Assessment, Safety Flags, Sierra Leone.

Introduction

Nigeria, Africa's most populous country with over 220 million people as of 2023, bears a disproportionately high burden of both communicable and non-communicable diseases [1, 2]. The country is among the eight nations that accounted for two-thirds of global tuberculosis cases [3] and continues to experience some of the highest rates of HIV and malaria in sub-Saharan Africa. Despite this disease burden, the health system remains chronically under-resourced and structurally fragmented, a paradox that has attracted sustained attention from policymakers and global health organizations.

Health care in Nigeria is funded through a mix of government taxes, out-of-pocket payments, social and community health insurance, private funding, donor support, and government support [4-6]. Although responsibility is shared among federal, state, and local governments, this setup has led to poor coordination, an unfair distribution, and families still having to pay out of pocket [7]. As a result, in 2017, Nigeria's out-of-pocket health spending accounted for more than 75 percent of total health expenditure, placing it among the highest globally [8].

Universal Health Coverage (UHC) refers to ensuring that all individuals and communities receive the health services they need without suffering financial hardship [9, 10]. To reach UHC, health financing systems must be sufficient, fair, and protective; these are standards that Nigeria's current system does not meet. The share of households facing catastrophic health costs rose from 16.4% in 2009/2010 to 48% in 2015/2016 [11]. Almost 40% of Nigerians live in poverty [12], and high out-of-pocket payments continue to impoverish families [13]. High OOP expenditure (resulting from low public health expenditure) contributes to the inaccessibility of health services and to inequitable and inefficient health financing [5].

Since 1999, Nigeria has made several major changes to its health financing policies, including five key policies that explicitly commit to specific levels of health care financing and should have affected health spending. These are the previous National Health Insurance Scheme (NHIS) law of 1999, now replaced by the National Health Insurance Authority (NHIA) Act 2022; the National Health Act (NHA) 2014, which encompasses the Basic Health Care Provision Fund (BHC PF); the National Health Policy (NHP); the 2016 National Health Financing Policy and Strategy (NHFPS); and the 2018 – 2022 National Strategic Health Development Plan II (NSHDP II). In this study, we merged these into four periods: the period from 2000 to 2005, covering the NHIS and the Abuja Declaration commitment in 2001, which stipulated that 15% of GDP be allocated to health; the period from 2006 to 2013, covering the post-implementation of NHIS, which started in 2005; the third period, from 2014 to 2019, covering the National Health Act (2014), which enshrines Nigeria's commitment to universal health coverage (UHC) and provides the legal framework for the operation of the health system in Nigeria, and the COVID-19 pandemic; and the fourth period, from 2020 to 2023, covering the most recent, the National Health Insurance Authority (NHIA) Act of May 2022, which, for the first time, made health insurance contributions mandatory, and the post-COVID-19 era [5, 6]. This study examines whether these laws have actually improved financial protection for households.

Existing Solution

Nigeria's future path can still change. Thomas-McLean et al. cited Costa Rica, Ghana, Rwanda, Sri Lanka, and Thailand as successful Universal Health Coverage (UHC) systems, crediting their success to shared risk pools, smart buying of services, strong primary care, and responsible governance. In contrast, Nigeria is grouped with Chad and India as a low

performer and does not exhibit these features to the same extent [14]. Importantly, the World Health Organization's 78th World Health Assembly resolution on health financing in 2025 supports this study's recommendation. The resolution calls on countries to pool government funds, including mandatory insurance, to lower out-of-pocket costs when people receive care [15]. Evidence from this study, other research, and global experience points to one conclusion: health financing must change, and government leadership is key.

Purpose and Objectives

This study examines trends in Nigeria's health financing from 2000 to 2023. The analysis follows these specific objectives:

1. To describe and quantify the key components and trends in Nigeria's health financing from 2000 to 2023 using GHED data.
2. To assess the burden of OOP health expenditure relative to international benchmarks across the full study period and four policy sub-periods.
3. To examine macroeconomic and health system correlates of OOP expenditure using correlation and bivariate regression analysis.
4. To test whether institutional reform transitions produced statistically significant changes in financing indicators using Wilcoxon signed-rank tests and effect size analysis.

Study Rationale and Novelty

Previous global studies, such as Micah et al., offer broad cross-national data on health spending trends but lack the Nigeria-specific detail necessary for effective policymaking [16]. This study addresses this gap by providing a multi-indicator, single-country longitudinal analysis using the most recent GHED release in December 2025 [8], encompassing ten financing indicators across four institutionally defined eras. Unlike studies limited to one or two outcome measures, this research reports on a comprehensive set of indicators relating to financial protection and evaluates the impact of each legislative reform transition. Additionally, the correlation analysis extends beyond income as the sole measure of vulnerability, instead examining structural financing composition as the primary determinant of household OOP burden. This approach more precisely identifies actionable policy levers for Nigerian decision-makers.

Materials and Methods

Data Source

This study uses secondary data from the WHO Global Health Expenditure Database (GHED), December 2025 release [8]. The GHED provides comparable health expenditure data for 195 countries from 2000 onward, underpinned by the System of Health Accounts 2011 methodology developed jointly by WHO, OECD, and Eurostat [8]. The main study period is 2000 to 2023, covering 24 annual observations for Nigeria, divided into four policy sub-periods aligned with key institutional milestones (Table 1).

Table 1. Analytical Sub-Periods and Policy Rationale

Policy Era	Years	Policy Rationale
Post-Abuja Declaration	2000–2005	Abuja Declaration (April 2001) commits Nigeria to a 15% health budget target. NHIS Act (1999) was enacted but non-operational throughout this period.
NHIS Voluntary Operations (Pre-reform)	2006–2013	NHIS formal operations commence (2005); voluntary enrolment remains below 5%; structural decline in

		GGHE-D; 2008 global financial crisis; GDP rebasing (2014).
Post-National Health Act (Post-NHIA)	2014–2019	National Health Act signed October 2014; BHCPF established; operationalization commences 2018–2019; NHIS voluntary framework continues.
COVID-19 Pandemic and NHIA Act	2020–2023	COVID-19 fiscal disruption (2020–2022); NHIA Act signed May 2022, introducing mandatory contributory insurance; 2023 is the first full year under the new framework.

Indicator Selection

Ten GHED indicators were selected based on their theoretical roles as predictors of household financial catastrophe or measures of OOP burden (Table 2). Out-of-pocket expenditure (OOPS) and out-of-pocket health

expenditure (OOPHE) are used interchangeably throughout the study. In the correlation and regression analyses, `oops_che` is the primary outcome, and `gghed_che` is the primary predictor; all 10 indicators are examined simultaneously in the heatmap analysis.

Table 2. Primary GHED Indicators Used in the Analysis

Indicator	Variable Name	Code	Primary Analytic Role
OOP expenditure as a share of CHE	Out-of-pocket (OOPS) as % of Current Health Expenditure (CHE)	<code>oops_che</code>	Primary dependent variable/outcome
OOP per capita (constant 2021 USD)	Out-of-Pocket Expenditure (OOPS) per Capita in US\$	<code>oop_pc_usd</code>	Secondary outcome: absolute per-person burden
Current health expenditure(CHE) as % of GDP	Current Health Expenditure (CHE) as % of Gross Domestic Product (GDP)	<code>che_gdp</code>	System scale control; secondary outcome (crowding-out)
GGHE-D as a share of CHE	Domestic General Government Health Expenditure (GGHE-D) as % Current Health Expenditure (CHE)	<code>gghed_che</code>	Primary independent variable: government financing share
GGHE-D as a share of GDP	Domestic General Government Health Expenditure (GGHE-D) as % Gross Domestic Product (GDP)	<code>gghed_gdp</code>	Secondary predictor: fiscal effort
GGHE-D per capita (PPP, constant 2021 USD)	Domestic General Government Health Expenditure (GGHE-D) per Capita in US\$	<code>gghed_ppp_pc</code>	Secondary predictor: fiscal capacity
Social health insurance as a share of CHE	Social Health Insurance (SHI) as % of Current Health Expenditure (CHE)	<code>shi_che</code>	Secondary predictor: risk-pooling depth

Private domestic prepayment as a share of CHE	Domestic Private Health Expenditure (PVT-D) as % Current Health Expenditure (CHE)	pvt_d_che	Secondary predictor: voluntary insurance contribution
External health financing as a share of CHE	External Health Expenditure (EXT) as % of Current Health Expenditure (CHE)	ext_che	Secondary predictor: donor dependency
CHE per capita (constant 2021 USD)	Current Health Expenditure (CHE) per Capita in US\$	che_pc_usd	Control variable: total system scale

Note: *oops_che* is the primary dependent variable; *gghed_che* is the primary predictor. *gghed_gdp*, *gghed_ppp_pc*, *shi_che*, *pvt_d_che*, and *ext_che* are secondary predictors. *che_gdp* and *che_pc_usd* are system-scale controls.

Data Preparation

Raw GHED data were downloaded in CSV and XLSX formats and processed using Python. Data preparation followed structured steps. First, the data were extracted by selecting Nigeria and the relevant available annual GHED indicator values for 2000 to 2023. Both reported and modeled values were retained, with modeled observations clearly flagged. Secondly, we assess the completeness of each indicator for the study period, ensuring that all variables have no missing data. The third stage involves monetary standardization, in which all per capita monetary values were converted to constant 2021 international dollars using Gross Domestic Product (GDP) deflators and Purchasing Power Parity (PPP) factors from the IMF World Economic Outlook [17]. The conversion formula is given as:

$$\frac{Value_{constant, 2021}}{GDP_Deflator_{2021}} = \frac{Value_{current}}{GDP_Deflator_{current\ year}} \quad (1)$$

Descriptive summaries were also computed, and time-series analyses, along with other statistical methods, were employed in the study. For the trend analysis, annual values for each primary GHED indicator were plotted, with vertical lines marking the four policy-relevant eras (Table 1). LOESS (Locally Estimated Scatterplot Smoothing) regressions were then overlaid to reveal underlying directional trends without forcing a linear shape on the data [20]. Annualized percentage changes were also computed for each indicator and each sub-

period (Table 1) using a log-linear regression framework. For any variable Y over a period t_1 to t_2 , the annualized growth rate (g) is derived from the regression of $\ln(Y_t)$ on t , where

$$\ln(Y_t) = a + \beta t + \epsilon_t \quad (2)$$

We then compute the growth rate g as:

$$g = (e^\beta - 1) \times 100 \% \quad (3)$$

Furthermore, we assessed the correlation and bivariate association using Pearson (linear) and Spearman (rank) correlation coefficients. The results were displayed using panel figures.

In the study, an autoregressive distributed lag (ARDL) model was used to identify macro-level GHED indicators that most likely predict the trajectory of OOPHE as a share of CHE in Nigeria. This method is particularly suitable because it handles small-sample time series with potentially non-stationary variables of mixed integration orders [18]. The general equation for the ARDL model is given as:

$$OOPHE_t = \alpha_0 + \sum_{i=0}^p \beta_i OOPHE_{t-i} + \sum_{j=0}^{q1} \gamma_j GGHE_{t-j} + \sum_{k=0}^{q2} \delta_k Z_{t-k} + \epsilon_t \quad (4)$$

Where $OOPHE_t$ is the OOPHE share of CHE in year t , $GGHE_t$ is GGHE-D as a share of CHE, and Z_t is a composite vector summarizing SHI, private domestic prepayment, and external financing shares. The lag orders p , $q1$, and $q2$ were chosen by grid search over $(p, q1, q2) \in \{0, 1, 2\}$ with AIC minimization, which conserves degrees of freedom in the 24 samples.

To examine the effects of different legislative health financing milestones and macroeconomic shocks, a comparative assessment was conducted across the four analytical sub-periods. This was achieved by estimating mean values and confidence intervals, conducting Wilcoxon signed-rank tests, and calculating effect sizes for the samples using Cohen's *d*. Cohen's *d* is computed as the difference of means divided by the pooled standard deviation. Effect sizes are interpreted with the standard thresholds (negligible $d < 0.2$, small $0.2 \leq d < 0.5$, medium $0.5 \leq d < 0.8$, large $d \geq 0.8$).

All analyses are implemented in Python and were executed in a Google Colab environment. Core libraries, *scipy.stats* (Wilcoxon, *t*-tests, bootstrap statistics), *seaborn*, and *matplotlib*. Intermediate datasets, tables, and figures are saved to a structured output folder.

While the study aims to answer the predefined questions, it is constrained by the aggregate indicator level. This is because the GHED indicators are national totals and cannot capture sub-national variation across Nigeria's 36 states and the FCT. Macro-level findings should be read alongside available household survey evidence from the National General Household Survey [11]. Also, the results are presented as longitudinal associations; therefore, causality is constrained by the observational time-series design and the limited set of instruments, which precludes causal inference. Legislative milestones are treated as quasi-experimental events, but concurrent macroeconomic confounding factors cannot be fully accounted for. The 2023 modeled estimate also has limitations for this study. The 2023 GHED data rely on WHO-modeled estimates due to the usual two- to three-year national health accounts compilation lag. Sensitivity analyses excluding 2023 are reported alongside the primary results to show how much that single observation drives the findings. Finally, we also report the limitations of this study since we used the catastrophic-expenditure proxy.

Direct CHE incidence data from household surveys are available for Nigeria only for 2010/2011 and 2015/2016. GHED OOPHE indicators are therefore used as a macro-level proxy for catastrophic-expenditure risk, in line with standard practice [19].

Limitations

Covers both the 2023 modeled-estimate issue and the deeper problem that GHED OOP figures are macro-level proxies rather than household-level CHE incidence measures. Future research should focus on annual or biennial household panel surveys as the only way to track whether the NHIA Act actually reduces catastrophic household expenditure.

GHED indicators are national totals and cannot capture differences across Nigeria's 36 states and the Federal Capital Territory; results should be considered alongside household survey data of 2010/2011 and 2015/2016. The results show associations over time; the study's design and limited tools do not allow for proving cause and effect. Legislative milestones are treated like natural experiments, but economic factors may still affect results. The 2023 GHED data are WHO estimates waiting for the usual two-to-three-year update; tests excluding 2023 data are included. Direct data on catastrophic health spending from household surveys are available only for 2010/2011 and 2015/2016; GHED out-of-pocket indicators are used as broad substitutes, following standard practice [19].

Results

Descriptive Statistics and Benchmark Comparison

Figure 1 describes the percentage of longitudinal annual bar graphs of Nigeria's health financial indicators from 2000 to 2023. The CHEs are dominated by out-of-pocket health expenses (*oops_che*). This financial indicator starts at 60.1% in 2000, rises to a maximum percentage in 2017 (77.4%), and slightly drops by 7% (71.9%) in 2023, though

2022 was 75.7%. On the other hand, domestic government general health spending as a share of CHE (gghed_che) shows a weak, decreasing trend, from 26.9% in 2001 to 14.3% in 2023. The other indicators, such as external health financing (ext_che) and social health insurance (shi_che), remain below 10% across all 24

years of the data. In addition, comparing national wealth (che_gdp) and health expenditures shows fluctuations, with little or no increase, within a narrow band that remains below the recommended 5% level throughout the time series.

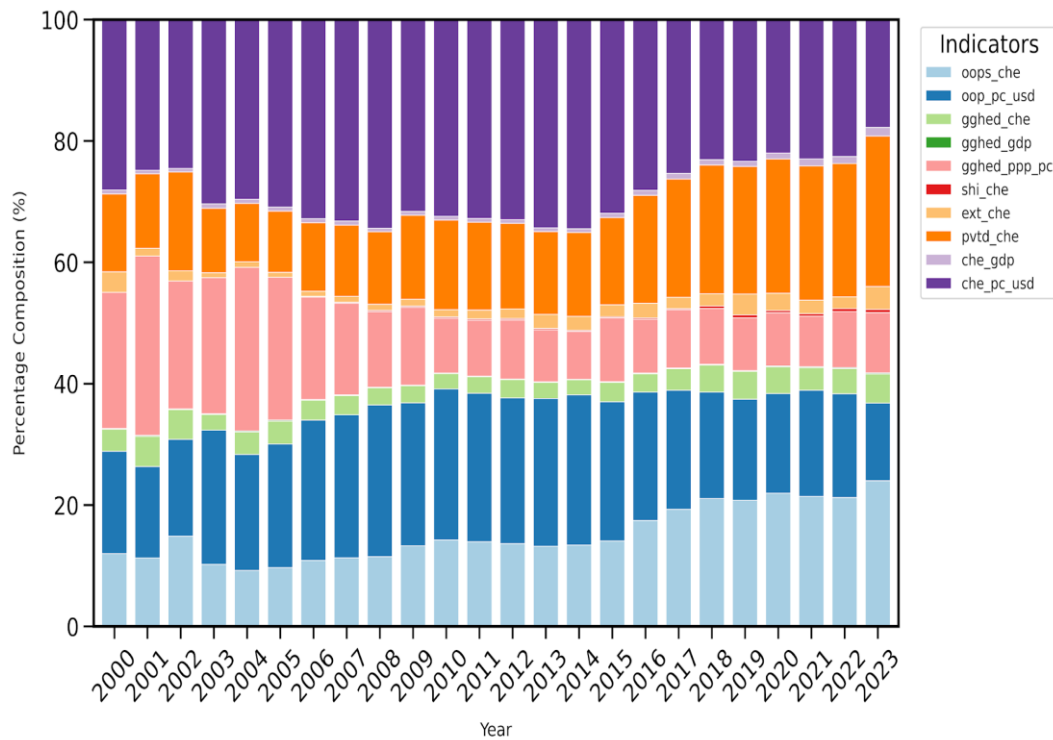


Figure 1. Longitudinal Annual Percentage Composition of Nigeria's Key Health Financing Indicators from 2000 to 2023

Table 3. Descriptive Statistics and WHO Benchmark or Global Target

Indicator	WHO/Global Target	Mean	SD	Variance	Min	Median	Max
che_gdp	≥5–6% GDP	3.7	0.6	0.3	2.5	3.6	5.1
che_pc_usd	≥USD 86	148.9	54.4	2957.1	53.3	169.3	218.4
gghed_che	≥50–60%	17.3	4.1	17.2	13.0	16.0	26.9
gghed_gdp	≥5%	0.6	0.2	0.0	0.4	0.6	1.2
gghed_ppp_pc	≥USD 86	74.4	49.6	2459.6	29.7	50.7	188.9
shi_che	≥20–30% CHE	0.9	0.6	0.3	0.0	1.1	1.7
ext_che	≤5%	8.4	2.9	8.3	5.4	7.5	17.0
pvtd_che	5–15% complementary	74.3	4.0	16.0	64.7	74.9	80.1
oops_che	≤15–20%	71.5	4.8	23.4	60.2	72.3	77.4
oop_pc_usd	Below gghed_ppp_pc	105.9	38.3	1467.2	38.3	122.9	158.9

Note: Nigeria's indicators do not meet WHO benchmarks for all primary financial protection measures. Critically, oop_pc_usd (mean USD 105.9) exceeds gghed_ppp_pc (mean USD 74.4), representing a structural financing inversion in which households individually outspend the government on healthcare.

Table 3 presents full descriptive statistics for all ten indicators across 2000–2023, benchmarked against WHO targets.

Table 3 compares the econometric assessment of national health financing indicators with established WHO target thresholds, means, deviations, and system variances. The results indicate that Nigeria fails to meet WHO benchmarks. This is evident in public health spending averaging only 0.6% of GDP (gghed_gdp), well below the recommended $\geq 5\%$ threshold. This creates a catastrophic reliance on domestic private pathways, with the mean out-of-pocket expenditure (oops_che) at about 71.5% of total health expenditure. These figures exceed the safe range of $\leq 15\text{--}20\%$ by more than threefold. Thus, the average per capita oop_pc_usd reaches \$105.90, structurally reversing the target by overtaking public purchasing power spending (gghed_ppp_pc) at \$74.40. Although the nominal current health expenditure per capita (che_pc_usd) meets global baselines at \$148.90, we find that national health funding (che_gdp) is stagnant at 3.7%. In addition, the

absence of a social health insurance strategy (shi_che = 0.9%) and over-reliance on external aid (ext_che) exceeding the 8.4% threshold put the system at high risk.

LOESS Trend Analysis

To understand shifts in household expenditures, fiscal planning, and the scale of the health system, we use LOESS in Figure 2 to extract the nonlinear signal across three panels while avoiding ambiguity over the study period (2000–2023). The results indicate that the household out-of-pocket burden (oops_che) persists and remains dominant, peaking at ~77.4% in 2017, then gradually declining via LOESS to ~71% by 2023. The gghed_che shows strong interannual variation, peaking in 2001 (26.9%) and 2004 and 2005 (over 25%), with a downward trend from 2005 to approximately 14.3% (2023), meaning that general government domestic spending crashed by almost 50%. In the same vein, the social health insurance (shi_che) and other risk-pooling schemes remain statistically penalized.

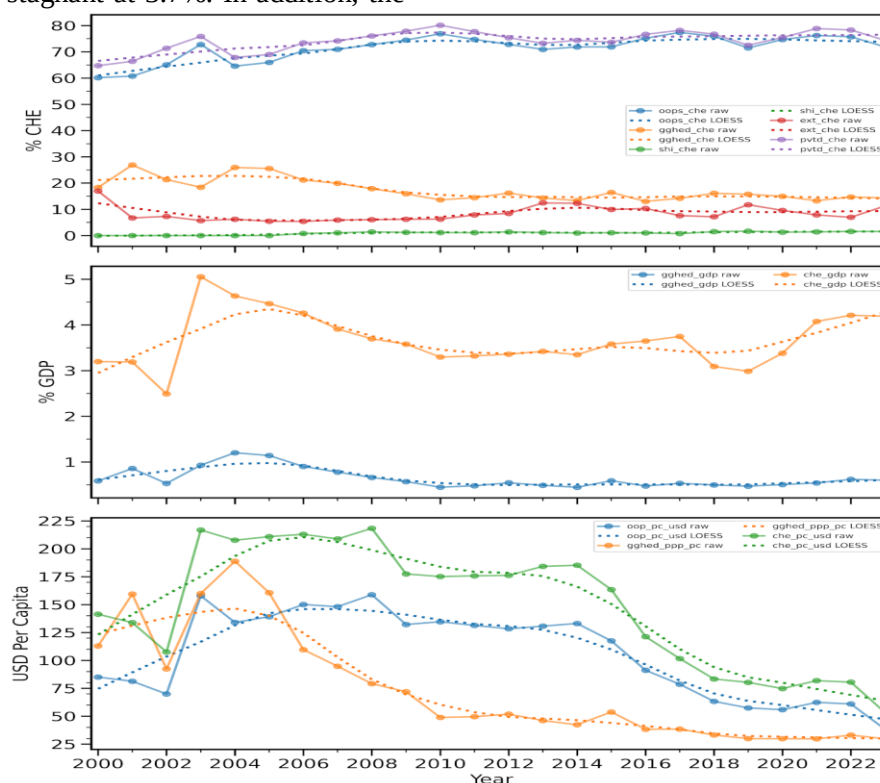


Figure 2. LOESS-Smoothed Trend Analysis Across Three Panels

Figure 2. Longitudinal time series and LOESS-smoothed trends of health financing indicators from 2000 to 2023. Indicators are compared between raw and LOESS-smoothed values, with the latter superimposed, for indicators expressed as a share of current health expenses (top), as a ratio of GDP (middle), and in constant per capita USD (bottom).

For the stagnant fiscal efforts demonstrated in the center panel (Figure 2), health

expenditure relative to che_gdp falls below the 5% level, indicating a shortfall in structural enhancement within the macroeconomic footprint. The last panel in Figure 2 shows that real health spending per capita (che_pc_usd) peaks in 2014 at a constant 2021 USD level of ~ \$102(raw without conversion) before declining. This signals a decoupling of systemic scale from expanding household financial demands.

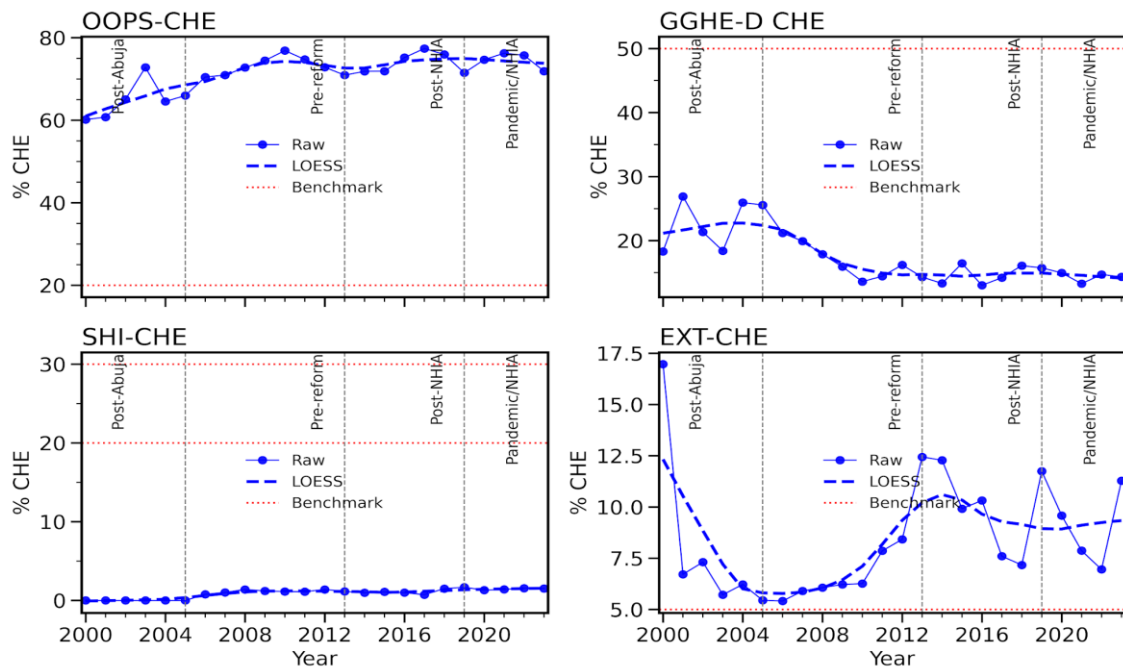


Figure 3. Comparative Trajectories and LOESS-Smoothed Trends of Key Health Financing Indicators Against International Benchmarks Across Policy Eras (2000-2023)

In Figure 3, we present the LOESS analysis of the tracks for health financing indicators relative to international benchmarks. The *oops_che* LOESS shows a wide gap relative to the 20% benchmark, while the trajectory remains consistently between 60% and ~80% throughout the study period. Conversely, the *gghed_che* shows a decreasing trend since 2001, when it was approximately 22%, and has stabilized below the 50% benchmark. After the small 2006 inflection in *shi_che*, the trend

remains negligible, staying below 10% and near the lower end of the 20% benchmark. However, the only indicator that consistently remains above the 5% benchmark is the *gghed_che*, which peaks during the post-NHIA era. These results show that Nigeria's health financing is structurally and statistically deficient. The more than 50% disparity between international standards and protocols and actual household spending indicates a severe financial catastrophe.

Sub-Period Mean Values and Annualized Changes

Table 4. Mean Indicator Values Across the Four Analytical Sub-Periods

Indicator	Post-Abuja	Pre-Reform	Post-NHIA	Pandemic/NHIA
oops_che	64.9	73.0	74.0	74.6
che_gdp	3.8	3.6	3.4	4.0
oop_pc_usd	111.3	139.3	90.2	54.4
gghed_che	22.7	16.7	14.8	14.3
shi_che	0.0	1.2	1.2	1.5
pvt_d_che	69.2	76.0	75.4	76.8
ext_che	8.1	7.3	9.8	8.9

From Table 4, we find that *oops_che* increases from 64.9% to 74.6% across the four policy eras analyzed. In contrast, the government's contribution declines from 22.7% to 14.3%, as shown by the *gghed_che* indicator. This shift is accompanied by a reduction in the absolute value of *oop_pc_usd* from \$139.3 to \$54.4 in the current era. Although there is a slight increase from 0% to 1.5% in the social health insurance (*shi_che*), the system remains highly dependent on private voluntary expenditure (*pvt_d_che*). The *pvt_d_che* grew from 69.2% to 76.8%, while the overall footprint of the health sector (*che_gdp*) remains

below 4.0%, except in 2021, with 4.1%, and in 2022 and 2023, with 4.2%.

Figure 4. Annual percentage growth rates of key health financing indicators across policy sub-periods (2000 - 2023). This horizontal bar chart quantifies the pace of change (with 95% confidence intervals) for indicators of household burden (e.g., *oops_che*), fiscal effort (e.g., *gghed_che*), and system architecture (e.g., *shi_che*) across four distinct legislative and economic eras: Post-Abuja (gray), Pre-reform (blue), Post-NHIA (red), and the Pandemic/NHIA (green) period.

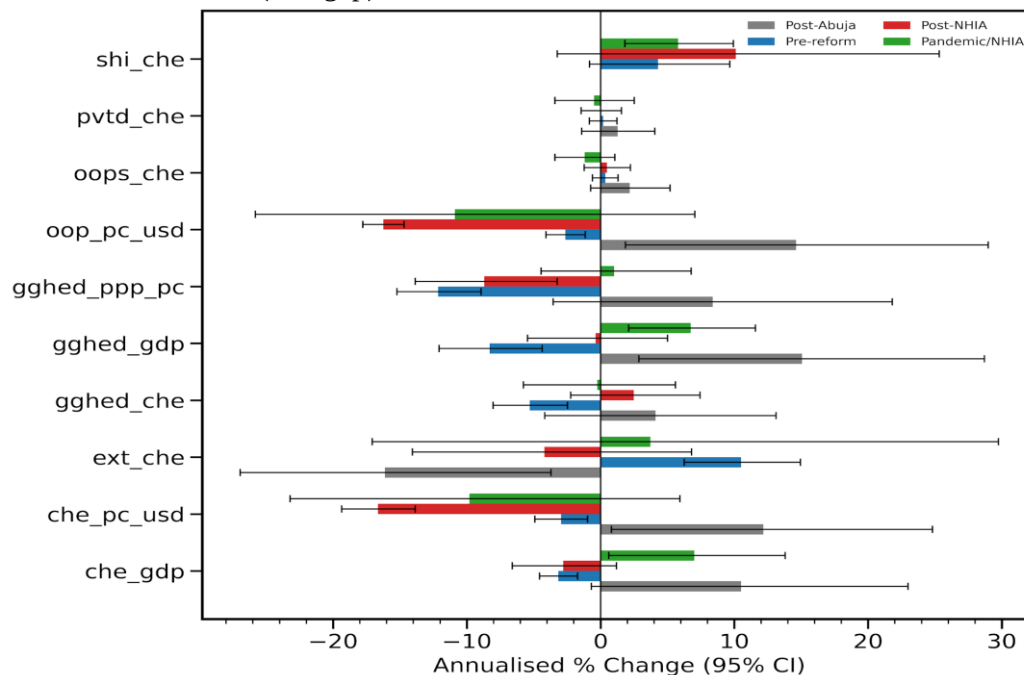


Figure 4. Annualized Log-Linear Growth Rates Per Indicator Across Policy Sub-Periods

Annualized log-linear growth rates by indicator and sub-period are shown in Figure 4 as a bar chart, grouped by indicator and policy period. The post-NHA window shows modest improvements in some indicators, largely reversed during the pandemic window. Specifically, pandemic/NHIA-era experiences include an upward surge in shi_che growth to ~30%, making it the highest in the localized risk-pooling structure, in contrast to the sharp contraction in the gghed_che post-Abuja era (-12%). The household financial burden appears statistically stagnant, with the oops_che indicating a 0% annual growth rate across all four policy eras, despite episodic shifts in funding sources. This suggests that legislative milestones have not yet significantly reduced relative out-of-pocket costs. A continuous stagnation in financial protection is reflected in a -15% decline in real per capita health spending (che_pc_usd). While these outcomes continue to decline as resources available per individual decrease, the use of formal insurance methods is increasing. The analysis, therefore, separates system formalization from fiscal scale, as insurance development has yet to attain the pace necessary to offset a declining per-capita resource base and ongoing household reliance on out-of-pocket expenses.

Institutional Reform Transitions: Wilcoxon Tests and Effect Sizes

Table 5 presents results from paired Wilcoxon signed-rank tests and Cohen's d effect sizes for the three sub-period transitions. These results directly address the study's fourth objective: whether institutional reform milestones produced statistically significant shifts in financing outcomes.

The results from the Paired Wilcoxon signed-rank tests and Cohen's d effect sizes analysis (Table 5) show that the transition from the Post-Abuja to the Pre-reform era is statistically significant across the series, among other structural shifts. This transition period shows a large (L) effect size, with increases in several components, such as the initial emergence of social insurance (shi_che: -7.57L; from 0.00 to 1.15), oops_che (-2.39L; from 64.88 to 73.00), and pvtd_che (-2.15L; from 69.20 to 76.00). In the Pre-reform vs. Post-NHIA transition periods, our results show a statistically significant and large (L) reduction in per-capita household costs (oop_pc_usd), which fell from 139.31 to 90.21 and 2.31L. Also, external funding (ext_che) expands significantly (-1.13L), from 7.32 to 9.84, within the same transition periods between the Pre-reform and Post-NHIA eras. Despite the large effect size in the Pandemic/NHIA era for che_gdp (rising to 3.96) and the increase in insurance in these recent shifts (though this is partly modeled), the outcome is insignificant at $p < 0.05$.

Table 5. Paired Wilcoxon Signed-Rank Tests and Cohen's d Effect Sizes Across Policy Era Transition (2000-2023)

Mean (Lower_CI, Upper_CI)					Cohen_d Effect_size, Wilcoxon_stat^Sig (p_val < 0.05 *)		
Indicators	Post-Abuja	Pre-Reform	Post-NHIA	Pandemic/NHIA	Comparison 1	Comparison 2	Comparison 3
oops_che	64.88 (61.24, 68.52)	73.00 (71.44, 74.56)	73.96 (71.94, 75.98)	74.64 (72.74, 76.54)	-2.39 L, 0*	-0.41 S, 7	-0.29 S, 4
che_gdp	3.84 (3.03, 4.65)	3.61 (3.37, 3.84)	3.40 (3.15, 3.65)	3.96 (3.58, 4.35)	0.33 S, 7	0.63 M, 2	-1.64 L, 0
oop_pc_usd	111.25 (81.81, 140.68)	139.31 (131.42, 147.19)	90.21 (66.15, 114.26)	54.40 (43.54, 65.25)	-1.11 L, 5	2.31 L, 0*	1.45 L, 0
gghed_che	22.74 (19.62, 25.86)	16.68 (14.77, 18.59)	14.81 (13.62, 15.99)	14.32 (13.59, 15.05)	1.85 L, 2	0.81 L, 4	0.38 S, 4
shi_che	0.00 (0.00, 0.00)	1.15 (1.01, 1.29)	1.16 (0.88, 1.45)	1.45 (1.34, 1.57)	-7.57 L, 0*	-0.05 N, 9	-0.99 L, 0
pvt_d_che	69.20 (66.01, 72.38)	76.00 (74.31, 77.69)	75.36 (73.62, 77.09)	76.76 (74.62, 78.90)	-2.15 L, 0*	0.28 S, 8	-0.64 M, 3
ext_che	8.06 (4.53, 11.59)	7.32 (5.72, 8.92)	9.84 (8.16, 11.52)	8.92 (7.04, 10.80)	0.22 S, 8	-1.13 L, 0*	0.45 S, 4

Note: Effect Size (Cohen's d): N = Negligible, S = Small, M = Medium, L = Large. Sig (*): Denotes statistical significance at the $p < 0.05$ level based on the Wilcoxon signed-rank test.
 Comparison 1 = Post-Abuja (2000 - 2005) vs Pre-reform (2006 - 2013); Comparison 2 = Pre-reform (2006 - 2013) vs Post-NHIA (2014 - 2019); Comparison 3 = Post-NHIA (2014 - 2019) vs Pandemic/NHIA (2020 - 2023).

The transition from the Post-Abuja to the Pre-reform era (Comparison 1) is statistically significant across multiple indicators and shows the largest structural shifts of any era transition. The emergence of social health insurance (shi_che) from zero represents the most dramatic structural change recorded across the full study period ($-7.57L$, $p < 0.05$), though its absolute scale, from 0.00% to 1.15%, remained financially negligible. OOP share rose sharply ($-2.39L$, $p < 0.05$; from 64.88% to 73.00%), as did private voluntary expenditure ($-2.15L$, $p < 0.05$; from 69.20% to 76.00%), indicating that the commencement of NHIS operations catalyzed increased private sector activity without reducing the household OOP burden.

The Pre-reform to Post-NHIA transition (Comparison 2) shows a statistically significant and large reduction in absolute per-capita household costs (oop_pc_usd: 2.31L, $p < 0.05$; from USD 139.31 to USD 90.21). However, as noted above, this decline reflects macroeconomic contraction and currency depreciation rather than improved financial protection, since oops_che, the oops share of total health spending, remained essentially

unchanged (from 73.00% to 73.96%). External financing expanded significantly during this transition ($-1.13L$, $p < 0.05$; from 7.32% to 9.84%), reflecting increased donor activity.

The Post-NHIA to Pandemic/NHIA transition (Comparison 3): the period that includes the landmark 2022 NHIA Act mandating contributory insurance does not reach statistical significance at $p < 0.05$ for any indicator. Despite large effect sizes for che_gdp ($-1.64L$) and nominal growth in shi_che ($-0.99L$), the instability of the Pandemic/NHIA period and the recency of the NHIA Act (first operational year 2023, partially modeled) mean the reform's effects are not yet statistically detectable. This is an important null finding: the most recent and most ambitious institutional reform has not yet produced measurable household financial protection.

Correlation Analysis

The correlation analysis examines all ten GHED indicators simultaneously without imposing directional structure. Figure 5 presents the multi-panel Pearson correlation heatmap.

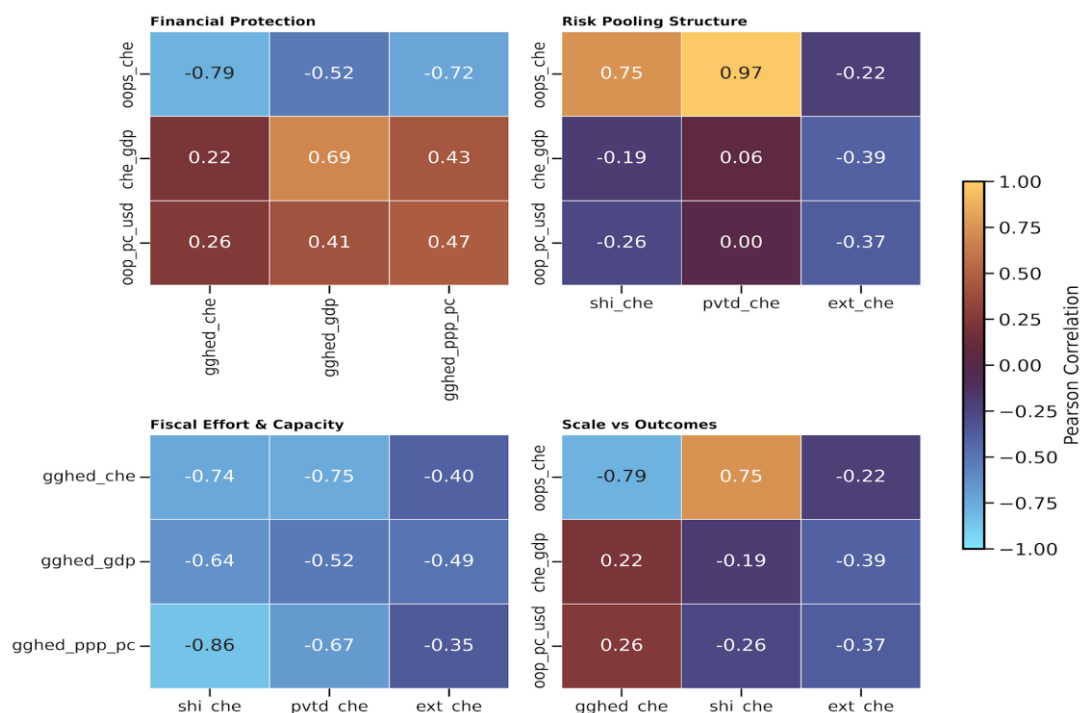


Figure 5. Multi-Pearson Correlation Heatmap of Nigeria's Health Financing Indicators

Four key patterns emerge. In the financial protection panel, a strong inverse relationship is observed between government financing share and household burden: *gghed_che* correlates negatively with both *oop_pc_usd* (-0.79) and *oops_che* (-0.72). In the fiscal effort and capacity panel, *gghed_gdp* shows strong inverse correlations with *gghed_che* (-0.74) and *gghed_ppp_pc* (-0.86), indicating that higher GDP-relative fiscal effort has not translated into higher government financing shares of CHE, a pattern consistent with documented budget fragmentation and off-budget health spending in Nigeria. In the risk-pooling structure panel, *pvt_d_che* is the strongest correlate of *oops_che* ($r = +0.97$), while the counter-effects of *ext_che* (-0.19) and *shi_che* (-0.22) are marginal correlations, confirming that donor financing and social

insurance are far too small to meaningfully offset private voluntary spending. In the scale-versus-outcomes panel, while *gghed_che* correlates negatively with *oops_che* (-0.79), *shi_che* correlates positively with *oops_che* ($r = +0.75$), suggesting that aggregate health system growth in Nigeria has not been accompanied by a commensurate shift in protective financing.

Bivariate Regression: Government Financing Share and Household OOP Burden

Figure 6 presents the bivariate Pearson and Spearman correlation scatter plot between *gghed_che* (government health financing share of CHE) and *oops_che* (household OOP share of CHE) across the 24-year study period.

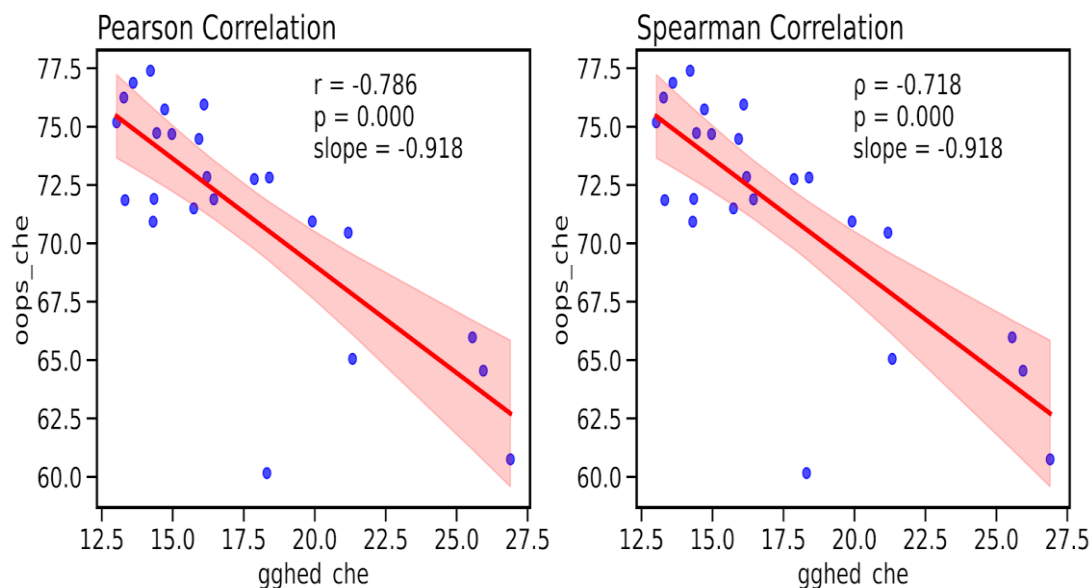


Figure 6. Bivariate Pearson and Spearman Correlation Between *gghed_che* and *oops_che*, Nigeria 2000–2023

The analysis confirms a significant negative relationship between government health investment and household OOP burden (Pearson $r = -0.786$, Spearman $\rho = -0.718$, $p < 0.001$ for both). The OLS regression slope ($\beta = -0.918$, 95% CI: $[-1.19, -0.65]$) indicates that for every one percentage-point increase in the government's share of current health expenditure, the household OOP share declines by approximately 0.92 percentage points. This

relationship is robust to both Pearson and Spearman measures, suggesting it is not substantially influenced by outliers or non-linearity. This finding provides quantitative evidence in the study that increasing the government's financing role is associated with reduced household financial burden and that the structural decline in *gghed_che* documented across the study period directly contributed to the rise in *oops_che*.

Discussion

Persistent Household Financial Catastrophe

The main finding of this study is that Nigeria's out-of-pocket share of current health expenditure has never fallen below 60% across 24 years. It has been above 70% and has shown no statistically significant downward response to any of the four institutional reforms examined. The scale is striking: a mean of 71.5%, more than triple the WHO ceiling of 15–20%. Its structural persistence stands out. Even at its minimum recorded value of 60.2%, the household OOP burden remains three times the international threshold needed for effective financial protection. This means domestic spending on health, which is key to achieving universal health coverage, shows no clear trend of increased government priority for health as reported by the WHO [**Error! Reference source not found., Error! Reference source not found., 21**].

This ongoing problem reflects a growing imbalance in how healthcare expenditures are paid for. Government health spending dropped from 22.7% after the Abuja Declaration to 14.3% by 2020–2023, while household out-of-pocket spending rose from 64.9% to 74.6% in the same time. A simple statistical analysis clearly shows this link: the Pearson correlation is -0.786 ($p < 0.001$), and the regression slope of -0.918 between government and household spending indicates that each 1% drop in government spending is associated with a similar increase in household spending. These findings align with those of Frimpong et al. [22], who also found similar links in their analysis. The current numbers (-0.79 , -0.22) confirm this strong relationship in Nigeria. Other studies worldwide show that more government or social insurance spending lowers out-of-pocket costs. In Nigeria, there is a need to further explore the underlying factors causing this opposite trend.

Another important issue comes from the correlation analysis. Total health spending as a share of GDP (che_gdp) is strongly linked to out-of-pocket spending ($r = +0.75$). This surprising result points to a key policy problem. Even though Nigeria's health system has grown alongside the economy, this link does not imply that one causes the other. Instead, it shows that growth is mostly due to private, voluntary, and direct household payments, not government or shared insurance funding. Growing the health system without changing its funding worsens the financial hardship households face when seeking healthcare. Private domestic prepayment (pvtd_che) and out-of-pocket spending are almost perfectly linked ($r = 0.97$), showing they both reflect the same basic problem: almost no risk sharing in Nigeria's health system.

What Institutional Reforms Have, and Have Not Achieved

After over 25 years of changes to the law, households are still not well protected. The Wilcoxon analysis shows three main points. After the National Health Insurance Scheme (NHIS) began in the pre-reform period (2006–2013), the largest change was the first appearance of social health insurance (-7.57L , $p < 0.05$), but this increase was small, rising from 0.00% to 1.15% of current health spending. Instead of lowering household costs, this time saw increases in both out-of-pocket and private voluntary spending (-2.39L and -2.15L , $p < 0.05$). This suggests that the NHIS encouraged more private-sector funding but did not reduce households' direct payments. Private spending went up alongside household spending, not instead of it.

The National Health Act of 2014 is often referred to as a major reform. The apparent improvement from before to after the NHIA period, as shown by a significant drop in per-person out-of-pocket spending (2.31L , $p < 0.05$; from USD 139.31 to USD 90.21), is largely misleading. The main measure, the out-

of-pocket share of health spending, changed by less than one percentage point and was not statistically significant. The drop in dollar spending occurred at the same time as an economic slowdown and currency losses after the 2014 oil price crash, not because households were better financially protected. This finding aligns with the WHO African region report that in 2020, only five countries achieved, while the remaining countries, including Nigeria, spent less than US\$ 249 per capita, with health expenditures ranging from US\$ 16.4 to US\$ 236.6, highlighting significant disparities across the region [23].

The 2022 NHIA Act represents the most ambitious reform examined in this study, as it introduces contributory insurance for the first time. However, the Wilcoxon analysis shows no significant changes at the start of 2022. This is expected, as the reform is new and still being implemented, and the 2023 GHED data are partly estimated. Still, the lack of immediate change is important. It establishes a clear baseline before the reform and shows that passing a mandatory insurance law alone does not guarantee financial protection. The main challenge now is to put it into practice well: getting the informal sector (about 80% of Nigeria's workers) to join, creating a suitable benefits package, regulating health maintenance organizations (HMOs), and, most importantly, raising government health spending from the current 4.2% to the Abuja Declaration goal of 15%, which Nigeria promised in 2001 but has not reached.

The financing challenges between 2020 and 2023. First, the government's share of health spending declined to its lowest level in 24 years, at 14.3%. Second, total health spending as a proportion of GDP remained below the World Health Organization's recommended minimum of 5%. Third, real per-person health spending decreased to levels last observed around 2000. The NHIA Act of 2022 was enacted during a period of economic difficulty, with the health system already weakened by

currency devaluation, the impact of COVID-19, and prolonged resource constraints. Although this context does not diminish the significance of the reform, it clarifies the lack of clear improvements in protective indicators, as shown by the LOESS analysis [24-27].

Conclusion

In conclusion, the findings show that Nigeria's health financing system has been deteriorating over the past decade. Over 24 years and four reform periods, the government's share of health spending has dropped by half, while household out-of-pocket spending has increased by nearly 10 percentage points. Social health insurance now accounts for only 1.5% of current health spending, and all key measures remain far below international standards for financial protection. Right now, Nigerian households spend more on health care than the government does, which runs counter to achieving Universal Health Coverage.

The 2022 NHIA Act is the main reform studied here, but its effects are not yet clear in the available data. This study provides a starting point for measuring its future impact. Passing the law alone is not enough. For mandatory insurance to truly protect households financially, Nigeria must do three things to achieve UHC/lower OOPs: provide steady funding to reach the Abuja Declaration's goal of 15% government health spending, require all workers to contribute, and strictly regulate benefits and the health maintenance organization (HMO) market to make sure insurance offers real protection when care is needed.

The main strength of this study is its detailed, Nigeria-specific analysis of the latest GHED data published in December 2025, covering four reform periods and using four methods. This gives a more up-to-date and strong evidence base for Nigerian health financing reform than earlier studies. Every year, millions of households are pushed into poverty by medical costs, showing how urgent reform is.

The data clearly point to the needed changes. The key question is whether there is enough political will now to make these reforms happen.

Conflict of Interest

The authors declare no conflict of interest.

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Ethical Approval

We used secondary open-source data from the World Health Organization website, available at <https://apps.who.int/nha/database/>. Ethical approval was not obtained because, since November 12, 2016, WHO publications have been made available under the CC Attribution-Non Commercial-ShareAlike 3.0 IGO license. This license allows any non-commercial use without the need to obtain permission from WHO. Adaptations and translations are also permitted, as long as the adapted work is published under the same or a similar license

(<https://www.who.int/about/policies/publishing/open-access>). Also, no direct human participants were involved, minimizing ethical concerns.

Data Availability

The data set analyzed in this study was generated and published by the World Health Organization and is available for download at <https://apps.who.int/nha/database/>. The Global Health Expenditure Database (GHED) provides comparable data on health expenditure for 195 countries, including Nigeria and territories, since 2000, with open access to the public. The secondary data analyzed in this study is available at an open source.

Author Contributions

The following authors were responsible for different areas of the study, as shown below:

- **Maria Ada Ochigbo:** Conceptualization, design, data extraction, first draft, review, and responding to feedback.
- **Nnodimele Onuigbo:** Overall supervision, mentorship, and guidance.
- **Tomvieceibe Cephas Dombo:** Data analysis using Python statistical, mathematical, or computational techniques to interpret data, review, and proofreading of the final test.

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