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# HEALTH INSURANCE COVERAGE AND FINANCIAL PROTECTION AMONG LOW-INCOME HOUSEHOLDS IN NIGERIA: EVIDENCE FROM THE NATIONAL HEALTH INSURANCE AUTHORITY (NHIA)

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## ABSTRACT

The health financing system in Nigeria is highly dependent on out-of-pocket (OOP) payments, which exposes households to catastrophic health expenditure (CHE) and impoverishment. Although the National Health Insurance Authority (NHIA) Act 2022 provides for coverage for all Nigerians, insurance penetration is extremely low, especially among low-income earners. This study investigated the relationship between health insurance coverage and financial protection among low-income households in Nigeria, testing whether coverage is negatively associated with OOP expenditure, CHE and delayed or forgone care. A quantitative explanatory design was applied to secondary data from the Nigeria General Household Survey (NGHS) 2023/2024, restricted to households in the lowest two consumption expenditure quintiles. Current enrolment status indicated coverage; OOP expenditure, CHE incidence at the 10% and 40% thresholds, delayed or forgone care, and coping strategies indicated financial protection. Data were analysed using descriptive statistics, chi-square tests, and multivariable logistic regression adjusted for the complex survey design. Only 2.2% of households were insured, and CHE incidence was 45.5% nationally, rising to 52.7% among rural poor households. Among the insured, coverage was associated with a 42% reduction in OOP expenditure during health shocks and significantly lower odds of CHE (AOR = 0.82, p = 0.042), although extremely low coverage limits protection at the population level. Health insurance in Nigeria is not yet providing meaningful financial protection. Expanding subsidised enrolment, improving benefit packages, and tracking financial protection outcomes are needed.

**Keywords:** Health insurance; Financial protection; Catastrophic health expenditure; Out-of-pocket expenditure; Low-income households; Nigeria.

## 1 INTRODUCTION

One of the highest shares of out-of-pocket (OOP) payments in total health expenditure in Nigeria is about 58.3% in 2024 [1], which is one of the highest in the world. A study conducted in Lagos also revealed that a significant proportion of households suffer from catastrophic expenditure, even in a relatively well-resourced state, with 15% of the households

surveyed being in CHE [2]. This dependency makes it difficult for low-income families to make ends meet, especially when it comes to paying for healthcare when they have other essentials to cover. The public health spending in Nigeria is only 3.9% of GDP, compared to the regional average of 5.1% (2018), while the incidence of CHE has been found to range from 13.7% to 47.6% across studies, as Nigeria has been deprived of much-needed public funding [3,4]. The latest nationally representative data estimates CHE at 45.5% at the 10% threshold [4], and high OOP spending is responsible for delayed treatment and foregone care, accounting for Nigeria's share of approximately 12% of the global burden of maternal mortality, of which 95% is preventable [5].

The main policy response has been health insurance in Nigeria. The National Health Insurance Authority (NHIA) Act of 2022 superseded the National Health Insurance Scheme (NHIS) and introduced the requirement for all Nigerians and legal residents to be insured, including a commitment to provide a basic minimum package, and safeguarding the rights of indigent and vulnerable persons [6–8]. The NHIS (established in 1999 and implemented in 2005) was limited to formal sector workers, whereas the NHIA extends coverage to all Nigerians and protection to indigents; the gap between this mandate and the capacity to implement it is the central institutional issue that this study examines. However, this ambition has not been matched by implementation: only 3.3% of reproductive-age women were insured in 2023/2024, ranging from 0.11% in the poorest quintile to 9.77% in the wealthiest quintile [9], and only 2.2% of Nigerian households overall reported any coverage [10]. Econometric evidence from recent studies confirms that enrolment is highly skewed by education, wealth, bank-account ownership and type of employment, with low income and informal-sector groups consistently least likely to be enrolled [11].

Recent evidence from the 2023/2024 NGHS indicates that CHE stood at 45.5% (10% threshold) and 43.1% (40% capacity-to-pay [CTP] threshold), with pro-poor concentration indices of −0.152 and −0.178, and with CHE of 52.7% among rural poor households compared with 48.0% among non-poor rural households [4]. A quasi-experimental analysis found that insurance reduced the increase in OOP expenditure during health shocks by 42% for insured households, while net loans decreased by 26% for the insured compared with a 31% increase for the uninsured, with an insignificant effect at the population level given 2.2% coverage [10]. The National Population Commission reported a steep coverage gradient by wealth (0.11% in the poorest to 9.77% in the wealthiest) and by residence (1.26% of rural women to 5.37% of urban women) [9]. Complementary sub-national and disease-specific studies show a high CHE burden among rural households in Delta State [12]; CHE incidence of 13.7–47.6% over 20 years with minimal improvement [3]; CHE incidence of 58.9% in a multicentre paediatric-surgery study in which three of four insured households did not experience CHE [13]; 15% CHE incidence in four Lagos LGAs, predicted by household size and chronic illness [2]; significantly higher catastrophic expenditure for non-communicable disease (NCD) care at private than at public facilities in Ekiti State [14]; and financial difficulty among lower-income households not only when OOP expenditure exceeds CHE thresholds but also when it is incurred on NCDs [15].

On the demand side, the same DHS-based logit and probit analysis identifies marital status and the age of the household head, in addition to education, wealth, bank-account ownership and type of employment, as jointly responsible for uptake [11], while moderate willingness to join community-based schemes among rural and informal populations suggests that trust and affordability, rather than information alone, are barriers to enrolment [16,17]. Evidence from other low- and middle-income countries shows that population coverage alone is not enough for protection and must be complemented by benefit adequacy and provider-payment capacity [18]; in Burkina Faso, a cluster trial of a mandatory scheme found a 50–56% reduction in OOP expenditure [19], a much larger effect than is currently observed in Nigeria, indicating potential to enhance protective design even in the presence of insurance. Overall, this literature demonstrates a positive but qualified relationship: coverage benefits those who have it, but at the population level in Nigeria, penetration is a major constraint on its impact.

The central issue is that health insurance coverage has not been successful in providing financial protection to low-income households over the past 20 years, despite policy commitments made by the NHIS (2005) and the NHIA Act (2022). There are three dimensions that need to be explored. First, there is a significant coverage gap with the informal sector accounting for the majority of employment, which has not been adequately reached by formal-sector oriented schemes [7], and state-level schemes have limited reach. Second, even if coverage is available, it does not necessarily lead to effective protection, as households could be formally insured but still face significant OOP expenditure due to benefit exclusions, provider payment inefficiencies, drug stock-outs, or their use of non-accredited providers [20], which reduces the effectiveness of insurance's rationale. Third, the evidence base on the insurance–financial protection nexus of low-income Nigerian households is still disjointed, despite the availability of nationally representative and survey design adjusted data. These gaps provide the rationale for this study's focus on assessing whether current health insurance arrangements provide meaningful financial protection to the poorest households in Nigeria.

### 1.1 Aim and objective

The aim is to examine the association between health insurance coverage and financial protection among low-income households in Nigeria using the NGHS 2023/2024. The specific objectives are to:

- Determine the level of health insurance coverage among low-income households, disaggregated by household and geographic characteristics.
- Assess the extent of financial protection, measured through out-of-pocket (OOP) expenditure, catastrophic health expenditure (CHE), delayed or forgone care, and coping strategies.
- Examine the relationship between insurance coverage and OOP expenditure among low-income households.
- Determine the association between insurance coverage and catastrophic health expenditure among low-income households.
- Assess whether insurance coverage is associated with reduced likelihood of delayed or forgone care due to cost among low-income households.
- Examine whether the insurance–protection association remains significant after controlling for household socioeconomic and demographic characteristics.

### 1.2 Research questions

- What is the level of health insurance coverage among low-income households in Nigeria?
- What is the extent of financial protection among low-income households in Nigeria?
- Is health insurance coverage associated with OOP healthcare expenditure among low-income households?
- Is health insurance coverage associated with catastrophic health expenditure among low-income households?
- Is health insurance coverage associated with reduced delayed or forgone care due to cost among low-income households?
- Does the insurance protection association remain significant after controlling for household socioeconomic and demographic characteristics?

### 1.3 Research hypotheses

- H1: Health insurance coverage has no significant association with out-of-pocket healthcare expenditure among low-income households in Nigeria.
- H2: Health insurance coverage has no significant association with catastrophic health expenditure among low-income households in Nigeria.
- H3: Health insurance coverage has no significant association with delayed or forgone healthcare due to cost among low-income households in Nigeria.
- H4: Health insurance coverage has no significant association with financial protection outcomes after controlling for household socioeconomic and demographic characteristics.

## 2 MATERIALS AND METHODS

### 2.1 Study design and scope

This study adopts a quantitative explanatory design using secondary data, appropriate for examining associations not causal effects given the cross-sectional data. The study covers all 36 Nigerian states and the Federal Capital Territory, reflecting the NGHS's national scope and enabling subgroup analysis.

### 2.2 Data source and target population

Data source: The fifth wave of the NGHS panel, carried out by the National Bureau of Statistics (NGHS 2023/2024) with the World Bank [4]. Data were collected using Computer-Assisted Personal Interviewing (CAPI) in two visits after planting (July to September 2023) and after harvesting (January to March 2024) from 4,715 households.

Target population: low-income households in the bottom 2 consumption quintiles (≈40%) of 1,886 of 4,715 households. The original GHS-Panel sample consisted of 5,000 households from 500 Enumeration Areas (EAs) across 37 states, of which 4,916 completed Wave 1. A partial refresh maintained in Wave 5 consisted of 511 EAs (157 long-panel, 354 refresh). The operationalisation of low-income households is based on the bottom two quintiles of consumption expenditure, which is consistent with the informal-sector context of Nigeria where consumption data is known to be reliable [4]; about 40% of households are in the bottom two quintiles of consumption expenditure and are most vulnerable to health shocks.

### 2.3 Theoretical and conceptual framework

This study is based on Andersen's Behavioural Model of Health Services Use [21], which conceptualises the use of health services as a function of predisposing characteristics (age, sex, education, household composition), enabling resources (income, insurance, geographic access), and need factors (chronic illness, health shocks). Insurance is explicitly an enabling resource, it should diminish financial barriers and burden, but this may depend on other resources, and may

be correlated with the probability of enrolment (adverse selection) and of expenditure (positive selection) for households with higher health needs.

The WHO Universal Health Coverage (UHC) framework provides the policy lens, identifying three dimensions (population, service, and cost coverage), all necessary for financial protection [18]. This study's findings must be understood in the context of the distinction between population coverage and population protection: coverage through enrolment is necessary but not sufficient for financial protection.

The conceptual framework (Figure 1) places financial protection (OOP expenditure, CHE incidence, delayed/forgone care, coping strategies) as the dependent variable, while household size, head characteristics, residence, geographic zone, presence of children under five, elderly members, and chronic illness are treated as controls. The framework recognises this relationship may be attenuated by benefit-package adequacy, provider-network characteristics, and supply-side factors, discussed as contextual explanations for observed patterns.

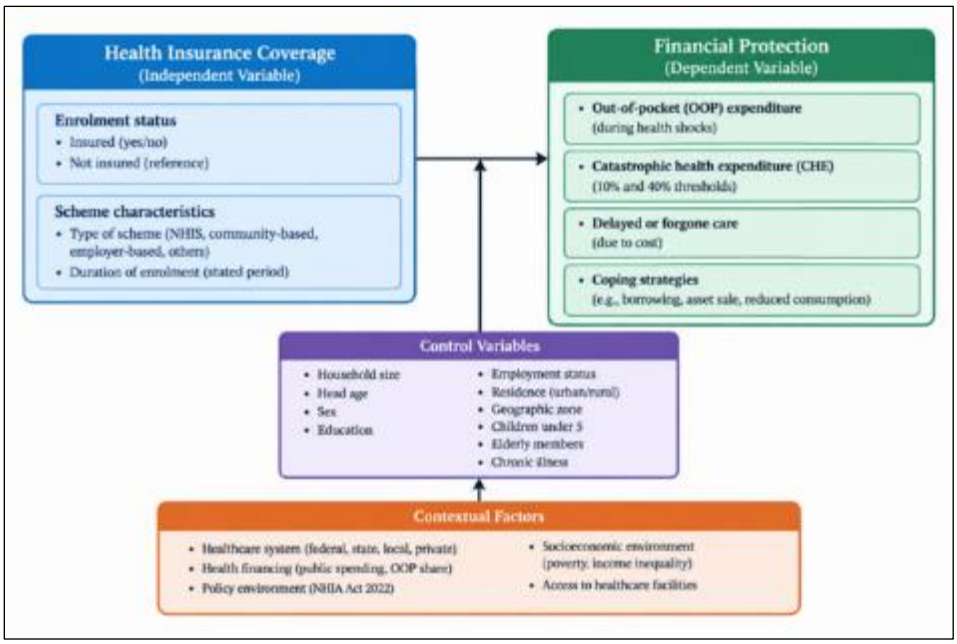


**Figure 1: Conceptual Framework Linking Health Insurance Coverage to Financial Protection**

### 2.4 Variables and measurement

Health insurance coverage is the proportion of households that have access to and use a financing mechanism that shares risk and lowers the financial cost of health care. This comprises the formal sector scheme by NHIA, social health insurance at the state level, private insurance, and community-based schemes in Nigeria [7]. The binary enrolment indicator is common, but can be misleading regarding the difference between nominal and effective coverage; a household can be formally enrolled but may have significant OOP costs because of benefit exclusions or supply-side factors [20], as in similar African systems [22]. This study draws on the WHO UHC framework to differentiate between coverage (formal enrolment) and effective protection (actual reduction in financial hardship) [18].

Financial protection means households have access to health care without significant hardship or impoverishment [18]. It has four dimensions here: (i) OOP constitutes 58.3% of Nigeria's total health expenditure in 2024 [1]; (ii) catastrophic health expenditure (CHE), where OOP is more than 10% of total consumption (World Bank method) or capacity-to-pay (WHO method) [4]; (iii) impoverishing expenditure, where OOP pushes households below the poverty line; and (iv) behavioural responses, namely delayed/forgone care and coping strategies [10].

Table 1 summarises variable operationalisation.

**Table 1: Variable definitions and measurement**

| Construct | Variable | Operational Definition | Coding | Source |
|---|---|---|---|---|
| Health insurance coverage (IV) | Insurance status | Current enrolment in any scheme | 1 = Insured, 0 = Uninsured | NGHS 2023/2024 |
| Financial protection (DV) | OOP expenditure | Direct household healthcare payments, past 4 weeks | Continuous (Naira) | NGHS 2023/2024 |
| Financial protection (DV) | CHE incidence | OOP exceeding 10% of household consumption | 1 = CHE, 0 = No CHE | NGHS 2023/2024 (World Bank method) |
| Financial protection (DV) | Delayed/forgone care | Delayed or forwent needed care due to cost | 1 = Yes, 0 = No | NGHS 2023/2024 |
| Financial protection (DV) | Coping strategies | Borrowed money or sold assets for healthcare | 1 = Yes, 0 = No | NGHS 2023/2024 |
| Control | Household size | Number of household members | Continuous | NGHS 2023/2024 |
| Control | Head age, sex, education | Demographic characteristics of household head | Continuous/Categorical | NGHS 2023/2024 |
| Control | Residence | Urban or rural | 1 = Urban, 0 = Rural | NGHS 2023/2024 |
| Control | Geographic zone | Geopolitical zone | 6 categories | NGHS 2023/2024 |
| Control | Children <5, elderly, chronic illness | Presence in household | 1 = Yes, 0 = No | NGHS 2023/2024 |

### 2.5 Data quality, validity and reliability

The NGHS is a study that relies on standardised instruments, and has adopted rigorous CAPI field procedures with live quality checks and post-collection cleaning [23], so validity/reliability concerns are focused on measurement. Self-reported expenditure and insurance status (recall and social-desirability bias) and a 4-week expenditure window that may underestimate expenditure for chronic or episodic conditions are key limitations.

### 2.6 Method of analysis

Method of analysis was carried out in three steps, taking into account the NGHS's complex survey design (weights, stratification, clustering). Descriptive statistics were used to describe the sample, and to compute coverage and protection indicators overall and by subgroup. The bivariate analysis involved chi-square tests for categorical outcomes and t-tests for continuous OOP expenditure. The association between insurance and each binary outcome was estimated using multivariable logistic regression with the following variables: household size, head age, sex, education, residence, geographic zone, children under five, elderly members, and chronic illness, and reported as adjusted odds ratios (AOR) with 95% confidence intervals. Multicollinearity checks (Variance Inflation Factor, VIF) and sensitivity analysis (40% capacity-to-pay, CTP, threshold) were performed.

The methodology used for CHE was based on the World Bank method (OOP > 10% of consumption), while the WHO method (OOP > 40% of capacity-to-pay) was used as a sensitivity check [4].

# 3 RESULTS

## 3.1 Sample characteristics

**Table 2: Sample and household characteristics**

| Characteristic | Category | Weighted % |
|---|---|---|
| Household head sex | Male | 77.4% |
| | Female | 22.6% |
| Household head age | Mean (SD) | 53.2 (15.0) years |
| Household head education | No formal education | 54.0% |
| | Primary only | 15.9% |
| | Secondary only | 25.3% |
| | Post-secondary | 4.8% |
| Household head employment | Unemployed | 0.7% |
| | Informal sector | 88.7% |
| | Formal sector | 10.6% |
| Household size | ≤5 persons | 43.0% |
| | 6–10 persons | 42.9% |
| | >10 persons | 14.1% |
| Presence of children <5 | Yes | 64.2% |
| Presence of elderly ≥60 | Yes | 35.8% |

Source: NGHS 2023/2024

The sample is largely male-headed (77.4%), poorly educated (54.0% with no formal education) and dominated by informal-sector employment (88.7%) which is the main insurance pathway in Nigeria. The majority of households (64.2%) have children under five years of age and 35.8% have elderly members, both associated with higher healthcare needs.

## 3.2 Health insurance coverage

Coverage is still very low, with only 2.2% of households reporting insurance coverage [10], meaning that about 97.8% of households face the entire cost of care.

**Table 3: Descriptive statistics for key continuous variables**

| Variable | Mean | Median | SD | N |
|---|---|---|---|---|
| OOP health expenditure, Naira (4 weeks) | 2,847 | 1,200 | 4,523 | 4,174 |
| Total household consumption expenditure, Naira | 156,420 | 142,800 | 98,750 | 4,715 |
| Household size | 6.2 | 6.0 | 2.8 | 4,715 |
| Household head age | 53.2 | 52.0 | 15.0 | 4,715 |

Source: NGHS 2023/2024

The right-skewed OOP distribution (mean well above median) indicates a small share of households incurring very high costs while many report low or zero expenditure.

### 3.3 Catastrophic health expenditure

**Table 4: CHE incidence by residence and wealth status**

| Residence | Wealth Status | CHE, 10% Threshold | CHE, 40% CTP Threshold |
|---|---|---|---|
| Rural | Poor | 52.7% | 51.5% |
| Rural | Non-poor | 48.0% | 45.4% |
| Urban | Poor | 49.5% | 47.1% |
| Urban | Non-poor | 36.3% | 33.1% |
| Total | Poor | 51.4% | 49.8% |
| Total | Non-poor | 40.2% | 37.5% |

Source: Aniebo et al. [4]

CHE stood at 45.5% nationally (10% threshold) and 43.1% (40% CTP). Pro-poor concentration indices (−0.152, −0.178) also show that the poorest households have a higher concentration of CHEs than the richest, with the rural poor having the highest concentration at both thresholds, and a larger CHE gap (14.1% versus 10.4% for non-poor rural households).

### 3.4 Health insurance and financial protection

**Table 5: Financial protection by insurance status**

| Outcome | Insured | Uninsured | Difference |
|---|---|---|---|
| OOP expenditure during health shock | 42% lower increase | Reference | −42% |
| Net loans during health shock | 26% decrease | 31% increase | −57 pp |
| CHE incidence, 10% threshold | 38.2% | 45.7% | −7.5 pp |
| CHE incidence, 40% CTP | 35.4% | 43.3% | −7.9 pp |

Source: Eze & Iheonu [10]; Aniebo et al. [4]

Protection is real but incomplete for the small insured minority: OOP expenditure during a shock increases 42% less while net loans decrease by 26% compared to an increase of 31% for uninsured households. This protective effect has a limited population reach with only 2.2% coverage.

### 3.5 Multivariable regression results

**Table 6: Multivariable regression for catastrophic health expenditure**

| Variable | AOR | 95% CI | p-value |
|---|---|---|---|
| Health insurance coverage | 0.82 | 0.68–0.99 | 0.042 |
| Household size | 1.12 | 1.08–1.16 | <0.001 |
| Presence of elderly member | 1.47 | 1.28–1.69 | <0.001 |
| Female-headed household | 1.38 | 1.19–1.60 | <0.001 |
| Rural residence | 1.28 | 1.12–1.46 | <0.001 |
| No formal education | 1.35 | 1.15–1.58 | <0.001 |
| Informal sector employment | 1.22 | 1.05–1.42 | 0.009 |
| Presence of children <5 | 1.18 | 1.04–1.34 | 0.010 |

Source: NGHS 2023/2024; adapted from Aniebo et al. [4]

After adjustment, insurance remains associated with significantly lower CHE odds (AOR = 0.82, p = 0.042), though modestly. Household size, elderly presence, female headship, rural residence, low education, informal employment, and young children independently raise CHE odds.

**Table 7: Robustness and sensitivity analysis**

| Model Specification | Insurance AOR | 95% CI | p-value |
|---|---|---|---|
| Primary model (10% threshold) | 0.82 | 0.68–0.99 | 0.042 |
| Alternative threshold (40% CTP) | 0.79 | 0.64–0.97 | 0.026 |
| Excluding zero-OOP households | 0.85 | 0.71–1.02 | 0.078 |
| Urban subsample | 0.78 | 0.61–1.00 | 0.048 |
| Rural subsample | 0.86 | 0.68–1.09 | 0.214 |

Source: NGHS 2023/2024

The protective association is strong at the 40% CTP threshold but is less significant when excluding zero-OOP households, and is strong in urban but not rural areas, consistent with a stronger provider network in urban areas.

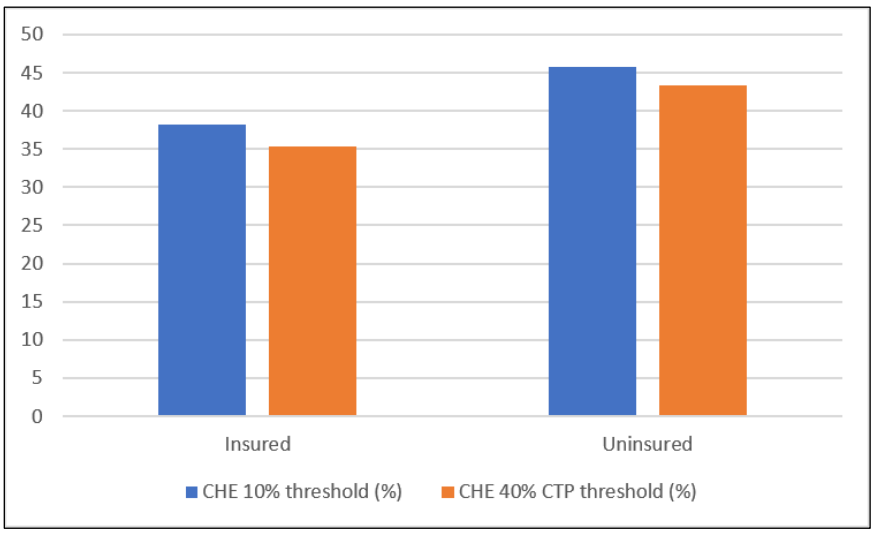


**Figure 2a: Catastrophic health expenditure (%) by insurance status, at the 10% and 40% capacity-to-pay thresholds. Source: Eze & Iheonu [10]; Aniebo et al. [4].**

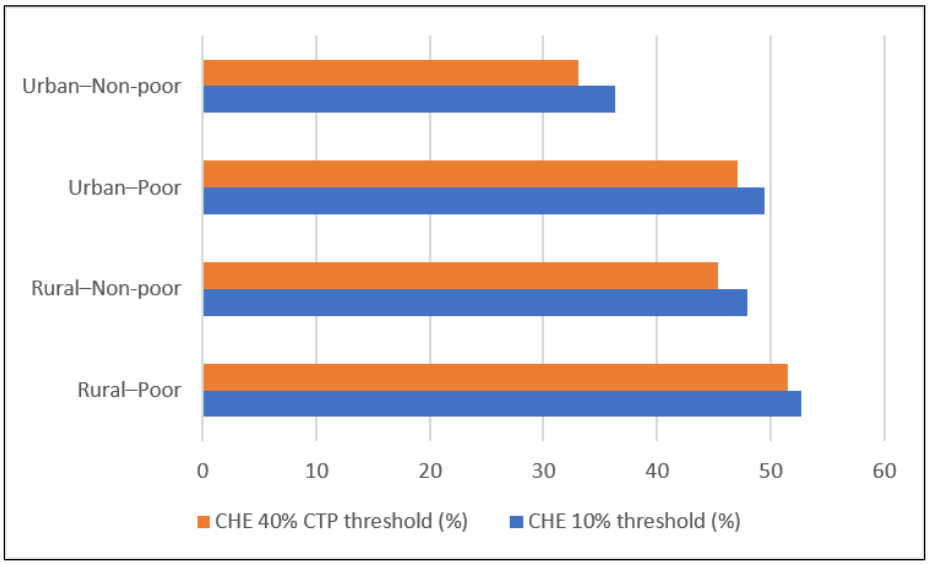


**Figure 2b: Catastrophic health expenditure (%) by residence and wealth status, at the 10% and 40% capacity-to-pay thresholds. Source: Aniebo et al. [4], using NGHS 2023/2024.**

## 4 DISCUSSION OF FINDINGS

### 4.1 Insurance coverage among low-income households

The low coverage rate of 2.2% corroborates the significant gap in Nigeria's health financing system [8,10,20]. The poorest 20% of the population have a gradient of 0.11% compared to 9.77% in the richest 20% [9], indicating that the poorest are least insured and insurance has historically been concentrated among formal-sector workers. The mismatch between an insurance system geared to formal employment and a largely informal workforce is still not fully addressed, as 88.7% of household heads are employed informally. This aligns with the findings of Effiong et al. [24] and Bashar et al. [25] that even state-sponsored schemes targeting vulnerable groups face difficulties in implementation without continuous funding for subsidies.

### 4.2 Financial protection outcomes

The CHE gap for the rural poor households is higher at 52.7%, indicating catastrophic payments take up a disproportionately high share of the limited resources of the rural poor households, whereas the CHE gap for the rural non-poor households is lower at 48.0% [4], confirming severe hardship as evidenced by the CHE incidence of 45.5%. The insured experienced a 42% OOP reduction and a decrease in loans, indicating that insurance is fulfilling its purpose; however, only a small proportion of the population is insured.

### 4.3 Insurance coverage and financial protection

The association is real but penetration is very limited. Despite insurance coverage, households still face some OOP exposure, which is 42% lower, but not eliminated as found elsewhere, in line with supply-side constraints and benefit limits [20]. This "insured but not protected" situation indicates that coverage without sufficient services does not completely fill the protection gap. On a population level, 2.2% coverage indicates that even with a good scheme, national CHE incidence cannot be meaningfully reduced, and that increasing coverage is a necessary but not sufficient condition for increasing protection.

### 4.4 Theoretical interpretation

The results are consistent with Andersen's Behavioural Model, which conceptualises insurance as an enabling resource; population-level impacts require enabling resources to be widely accessible. The three dimensions of the WHO UHC framework are also evident: Nigeria has made very little progress on coverage of the population, and even for those who are covered, coverage of costs may be incomplete [18].

### 4.5 Comparison with existing literature

Although reform has taken place, the 45.5% CHE incidence is not significantly better than the range of 13.7–47.6% recorded over 20 years [3]. The reduction in OOP by 42% is comparable to the 50–56% reduction recorded in Burkina Faso [19], indicating the potential to improve the design of Nigeria's existing insurance schemes. The 2.2% estimate is similar to the 3.3% women's coverage rate recorded by NDHS [9] and the paediatric surgery result of three out of four insured households not experiencing CHE [13] supports the regression findings.

## 5 CONCLUSION

The study analysed the relationship between health insurance coverage and financial protection in low-income households in Nigeria based on the NGHS 2023/2024. Coverage is still very low (2.2%) and very unequal by wealth quintile, and almost half of Nigerian households (45.5%) incur catastrophic health expenditure, mostly affecting the poor and rural households (52.7% among the rural poor). Insurance is not fully protective; even when insured, most low-income households are not completely protected from health shocks, as insurance is associated with only a 42% OOP reduction during health shocks and significantly lower CHE odds (AOR = 0.82) among the small insured population. The study also finds that health insurance coverage in Nigeria is still inadequate in terms of coverage as well as benefit-adequacy, and that increasing the coverage of effective health insurance among the poor is a prerequisite for achieving universal health coverage.

### *Recommendations*

The study recommends that:

- NHIA and state agencies increase subsidised enrolment for the poorest two quintiles through community-based enrolment, mobile units and social protection programme integration [8].
- The cost of essential drugs, diagnostics and emergency care be included in benefit packages to reduce the persistent OOP expenditure among insured households [10].
- The number of accredited provider networks in rural areas be increased to lower access barriers for the rural poor, who make up 52.7% of the CHE incidence [4].
- Financial protection indicators, such as CHE and OOP expenditure, disaggregated by wealth and residence, should be monitored regularly, in addition to the enrolment figures.
- Supply-side constraints (drug stock-outs, informal payments) be addressed through stronger provider-payment enforcement [20].
- Insurance expansion be geographically targeted toward rural poor households, given their double burden of high CHE and low coverage.
- National implementation design is informed by lessons learnt from state-level successes like the Basic Health Care Provision Fund (BHCPF) in Imo State, which has helped to support more than 516 referral cases and free emergency surgeries [26].

### 5.1 Limitations and future research

Because of the cross-sectional design, the data cannot be used to make causal inferences; longitudinal data would be required to make temporal inferences. Insurance status and expenditure is self-reported and thus susceptible to recall and social-desirability bias. The NGHS records enrolment status, but not the type of scheme, length of coverage, or the characteristics of the benefit package, so it is not possible to identify which schemes are most protective. The coverage rate is 2.2%, which restricts the statistical power and increases the confidence interval of insurance-related estimates. Residual confounding may be caused by unmeasured factors that affect enrolment and expenditure at the same time. In addition, in eight NWEs in the North West, conflict events hindered interviews, which could impact representativeness for the region [23]. Future research should employ panel data to explore causal pathways as NHIA Act coverage grows, break down insurance by scheme type and benefit adequacy, and measure impoverishment and longer-term economic outcomes.

## STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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### *Disclosure of conflict of interest*

The authors declare no financial or non-financial conflicts of interest.

### *Statement of ethical approval*

The data used is de-identified, secondary data from public sources that was collected under an NBS ethical approval; no additional ethical clearance was required and the use of the data was in accordance with the citation requirements of the data producer

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