Determinants of Households Out-of-Pocket Health Maintenance Costs in Nigeria

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Abstract
The rising out-of-pocket healthcare expenditures reflect changes in the healthcare market as businesses are increasing the employee-paid share of healthcare costs so that these costs fall back on the households. This article examines the determining factors for health maintenance costs. Generalised linear models were employed to determine the variation in health insurance coverage and out-of-pocket expenditures, using health maintenance households' survey data. Results show that: family size, employer and income are the significant socio-economic determinants; insurance coverage and benefits from National Health Insurance Scheme are the health insurance contributors while consultation of care provider and affordability of prescription drugs are health maintenance determinants. Moreover, employer, income, regular use of prescription drugs, health insurance coverage, insurance awareness, benefits and policy affordability are causal determinants of health insurance coverage. Consequently, there is evidence that households, with health insurance coverage, have higher out-of-pocket expenditures, which is in contrast to the belief that insurance coverage reduces out-of-pocket expenses. Findings suggest the presence of moral hazards and adverse selection in the healthcare system, which calls for a risk-adjusted capitation regime taking into account households' characteristics. Deliberate policy and strategies for reducing the burden of out-of-pocket expenses and addressing the variations resulting from the causal determinants should be instituted.

Keywords: determinants, generalised linear models, healthcare, NHIS, out-of-pocket expenses

Introduction

The increase in healthcare expenditures worldwide has prompted countries to look for health financing arrangements, which ensure that citizens are not denied access to care because they cannot afford it. Healthcare financing is a collection of funds from both public and private sources, including donor agencies to pay for services from healthcare providers (Oyibo, 2011). Access to healthcare services in Nigeria is constrained by consumers' financial incapacities to pay for healthcare services; a phenomenon that is common to most developing countries (Adeleke *et al.*, 2012).

Over the last decade, healthcare funding in Nigeria has been by means of budgetary subvention mainly from oil export earnings, which have experienced a downturn in recent times. To increase access, the government introduced the National Health Insurance Scheme (NHIS) in 1999 with the broad objective of ensuring that every Nigerian has access to good healthcare services at affordable cost through various prepayment systems. The Scheme is set up to operate as a Public Private Partnership (PPP) and directed at providing accessible, affordable and qualitative healthcare for all Nigerians. It is categorised as a social health insurance (NHIS Guidelines, 2012). The main thrust of the NHIS is to protect families from the financial hardship of huge medical bills, ensure equitable distribution of healthcare costs among different income groups, maintain a high standard of healthcare services delivery within the scheme and elevate private sector participation in the provision of healthcare services (Adeleke *et al.*, 2012).

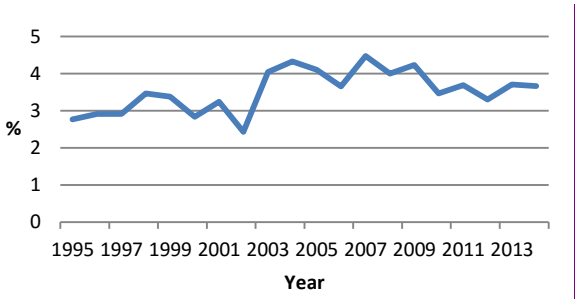


Figure 1: Total Health Expenditures (THE) % Gross Domestic Product (GDP) (Source: WHO, 2014)

With the decline of the Nigerian economy, mounting external debts burden and rapid population growth, the government funding for healthcare reached its peak in 2007 with only 4.47% of the Gross Domestic Product (GDP) and steadily declined to 3.67% in 2014 (Figure 1). The result is a rapid decline in the

quality and effectiveness of publicly provided healthcare services.

Healthcare expenditures in Nigeria, according to WHO (2014), is dominated by private healthcare spending and out-of-pocket (OOP) expenditures while general government healthcare expenditures, as a percentage of total healthcare expenditures, is lagging behind. This can be clearly observed from the healthcare expenditures indicators displayed in Figure 2. While most high income countries rely on either general taxation or mandated social health insurance contributions to finance their medicare, low income countries depend on OOP expenses.

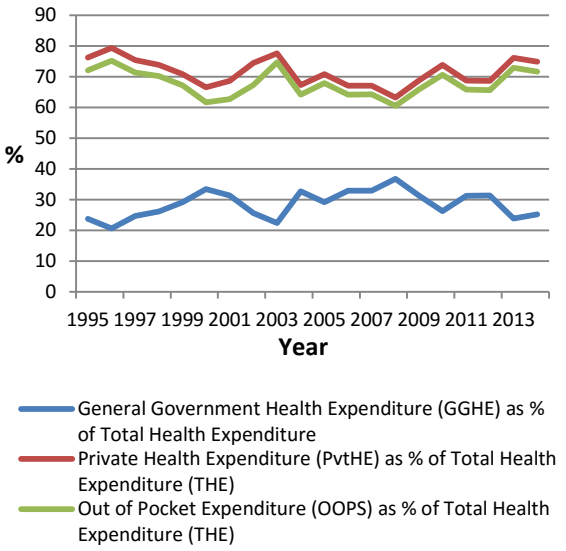


Figure 2: Class of Healthcare Expenses as Percentages of Total Healthcare Expenditures (Source: WHO, 2014)

Financing healthcare in the less developed and some developing countries is still characterised by the domination of OOP expenses and the comparative lack of prepayment mechanisms, such as health insurance. This is because most households in such countries are without full health insurance coverage thereby facing the risk of incurring large medical expenses whenever a household member falls ill. Important insights on the economic consequences of health shocks have been provided by several studies across countries to reshape public policies around healthcare issues and concerns (Uzochukwu and Uju, 2012). Health policies are concerned with not only improving health status of the population but also with protecting households from the financial burden of illness (Peters *et al*., 2002).

With the total healthcare expenditures, as a percentage of decreases in GDP, the total OOP expenses paid by families and households have increased in recent years and the shares of healthcare spending by government have also reduced (WHO, 2014; Levit *et al.*, 1998; Kumara and Samaratunge, 2016; da Silva, *et. al.*, 2015).

As their expenditures for healthcare increases, employers and insurers are shifting their growing portion of the cost to families and households by increasing copayments, deductibles and premiums (Aaron, 1994; Acs and Sabelhaus, 1995; Huskamp and Newhouse 1994; Levit, *et al*, 1990, 1998; Paulin and Wolf, 1995; Rubin and Koelln, 1993). The rising OOP healthcare expenditures reflects changes in the healthcare market as businesses are increasing the employee-paid share of healthcare costs so that these costs fall back on the households. OOP healthcare expenditures paid by households of all types are expected to increase substantially.

Moreover, as changes in healthcare policies are debated, detailed information on households' health expenses is key to national and state healthcare policy planning and business decision-making. Despite the importance of data and information on household healthcare expenditures, few studies have been undertaken to examine OOP healthcare services costs in Nigeria (Uzochukwu and Uju, 2012; Riman and Akpan, 2012; Oyinpreye and Moses, 2014; Onwujekwe *et al*., 2010).

The purpose of this study is to investigate the determinants of health insurance coverage and OOP expenses in Nigeria, using health maintenance costs survey data. The research questions addressed are: How does health insurance coverage relate to households' socio-econo-demographic, insurance and healthcare characteristics? What are the socio-econo-demographic, insurance and healthcare characteristics determinants of costs of drugs? What are the socio-econo-demographic, insurance and healthcare characteristics determinants of the costs of consultancies? What are the socio-econo-demographic, insurance and healthcare characteristics determinants of medical expenses? What are the socio-econo-demographic, insurance and healthcare characteristics determinants of total OOP costs?

Materials and Methods

Research Design

Households' survey was carried out in the Federal Capital Territory (Abuja) and 3 States (Lagos, Kano and Rivers) in Nigeria. The survey began with a pre-test in September 2013 while the final stage of the survey took place in January 2015. A two-stage purposive sampling procedure was employed. Firstly, 3 States and Abuja were selected due to their

metropolitan nature, where it is expected that all socio-ethno-religious groups are represented. At the second stage, questionnaires were administered to selected households, based on access, availability and levels of literacy.

The questionnaire consisted of 41 questions; 9 socio-demographic variables, 12 health insurance variables, 15 health maintenance variables and 5 employment details variables. A total of 1,852 questionnaires were administered and 1,100 were retrieved, representing a 59% response rate. The data was screened, captured and edited using spreadsheets.

Table 1: Frequency Description

Variable	Description	Frequency	Percentage (%)
Gender	Male	724	65.8
	Female	376	34.2
Age group	Late teenage	46	4.2
	Early adulthood	842	76.8
	Middle age	204	18.6
	Senescence	4	0.4
Marital Status	Single	571	51.9
	Married	453	41.2
	Divorced	24	2.2
	Separated	51	4.6
Education	Ph.D./Master's	285	25.9
	B.Sc./HND	579	52.6
	ND/NCE	117	10.6
	SSCE/WASCE	84	7.6
	Others	32	2.9
Employer	Self	373	33.9
	Private	424	38.5
	Government	303	27.5
Working Hours	8–10 hours	291	26.5
	10–20 hours	79	7.2
	20–40 hours	571	51.9
	Others	157	14.3
Income compared to Poverty line	High	65	5.9
	Middle	631	57.4
	Low	388	35.3
	Near poor	12	1.1
Insurance Coverage	Yes	343	31.2
	No	757	68.8
Awareness of Health Insurance Policy	Yes	772	70.2
	No	328	29.8
Health Insurance Coverage	Yes	317	28.8
	No	783	71.2

Relying on the earlier works of Hong and Kim (2000), Rubin and Koelin (1993) and Stum *et al.* (1996) on OOP medical expenditures, the dependent variables were: cost of drugs, cost of consultancies, medical expenses and total costs. The study did not consider insurance premiums as part of out-of-pocket expenditures since the NHIS is capitation-based.

In addition to investigating the aggregate healthcare costs, the study also considered the cost constituents (viz: cost of drugs, cost of consultancies and medical expenses). These expenses are the additional costs incurred by patients outside health insurance. The independent variables are categorised into individual characteristics: employment details, health insurance and health maintenance characteristics. 2 hypotheses were formulated to assess the significance of the underlying determinants:

I: Socio-econo-demographic, health maintenance and insurance characteristics are determinants of health insurance coverage.

II: Socio-econo-demographic, health insurance and health maintenance characteristics are determinants of out-of-pocket expenses.

Sample Characteristics

Table 1 describes the characteristic variables and provides summary statistics that suggest the effects on the probability of households' OOP medical expenses whereas Table 2 shows the distribution of the health insurance coverage across explanatory variables.

Table 2: Insurance Status by Household Characteristics

Variable	Description	Possession of Health Insurance	
		Yes (%)	No (%)
Gender	Male	202 (63.7)	522 (66.7)
	Female	115 (36.3)	261 (33.3)
Age group	Late teenage	13 (4.1)	33 (4.2)
	Early adulthood	243 (76.7)	599 (76.9)
	Middle age	61 (19.2)	143 (18.4)
	Senescence	0 (0)	4 (0.5)
Marital Status	Single	167 (52.7)	404 (51.7)
	Married	129 (40.7)	324 (41.4)
	Divorced	10 (3.2)	14 (1.8)
	Separated	11 (3.4)	40 (5.1)
Education	Ph.D./Master's	169 (53.5)	116 (14.9)
	B.Sc./HND	107 (33.9)	472 (60.4)
	ND/NCE	15 (4.7)	102 (13.1)
	SSCE/WASCE	10 (3.2)	74 (9.5)
	Others	15 (4.7)	17 (2.2)
Religion	Christianity	220 (69.4)	431 (55.0)
	Islam	86 (27.1)	325 (41.5)
	Traditional	1 (0.3)	15 (1.9)
	Others	10 (3.2)	12 (1.5)
Income compared to Poverty line	High	36 (11.4)	29 (3.7)
	Middle	195 (61.5)	436 (56.0)
	Low	84 (26.5)	304 (39.0)
	Near poor	2 (0.6)	10 (1.3)
Rating of Healthcare Provider	Affordable	270 (85.2)	608 (77.8)
	Cheap	35 (11.0)	58 (7.4)
	Expensive	12 (3.8)	115 (14.7)
	No	783	71.2

Methods

NHIS enrollment is influenced by the following determinants: individual, household, health insurance and health maintenance characteristics. Individual and household characteristics include: age, gender, family size, religion, employment details, educational background and income, etc. The health insurance factors are: health insurance status, health insurance coverage, policy affordability and availability. Health maintenance characteristics are healthcare service ratings, mode of health service payment, frequency of drug utilisation, affordability of drugs and healthcare costs.

To estimate the contribution of these determinants on healthcare coverage, a generalised logit regression was employed (Frees, 2010; Lemaire, 1991). The OOP healthcare costs were also assumed to be dependent on these characteristics. Based on the exploratory data analysis findings, the generalised linear model is considered suitable for modelling and testing the requisite hypothesis.

Generalised Logit Regression Models

Generalised logit models use the linear combinations of explanatory variables of the form

$$V_{i,j} = x_i'\beta_j \quad (1)$$

with the response variable being modelled as a linear combination of explanatory variables, plus an error term and uses the probabilities

$$\Pr(y_i = j) = \pi_{i,j} = \frac{\exp(V_{i,j})}{\sum_{k=1}^{c}\exp(V_{i,j})} \quad (2)$$

where β_j is the corresponding vector of parameters and x_i are the explanatory variables.

The maximum likelihood method is used to estimate the parameters β_j. Thus, the log-likelihood of the observed values is

$$\begin{cases} \ln(1-\pi_i) & if\ y_i = 0 \\ \ln \pi_i & if\ y_i = 1 \end{cases}$$

with the log-likelihood of a single observation written as $y_i \ln \pi\,(x_i'\beta) + (1-y_i)\ln(1-\pi\,(x_i'\beta))$

where $\pi_i = \pi(x_i'\beta)$ and the log-likelihood of the dataset is

$$L(\beta) = \sum_{i=1}^{n}(y_i \ln \pi\,(x_i'\beta) + (1-y_i)\ln(1-\pi\,(x_i'\beta))) \quad (3)$$

The log-likelihood is viewed as a function of the parameters with the data held fixed.

The maximisation of the log-likelihood function, with respect to β, yields the score equations

$$\frac{\partial}{\partial\beta}L(\beta) = \sum_{i=1}^{n} x_i\left(y_i - \pi(x_i'\beta)\right) = 0 \quad (4)$$

where $\pi(z) = (1+\exp(-z))^{-1}$.

Then, the Likelihood Ratio Test (LRT) for testing model adequacy is

$$LRT = 2 \times (L(\boldsymbol{b}_{MLE}) - L_0) \quad (5)$$

where, L_0 is the maximised log-likelihood with only an intercept term and $\boldsymbol{b}_{MLE}$ is maximum likelihood estimate of β.

A measure of the goodness-of-fit is the pseudo-R^2 obtained from

$$\frac{L(\boldsymbol{b}_{MLE}) - L_0}{L_{max} - L_0}$$

where L_{max} and L_0 are the log-likelihood, based on maximum achievable and on intercept only, respectively, and

$$R^2 = 1 - \left(\frac{exp\left(\frac{L_0}{n}\right)}{exp\left(\frac{L(\boldsymbol{b}_{MLE})}{n}\right)}\right) \quad (6)$$

Generalised Linear Models

Generalised linear models (GLM) are based on an exponential family, where mean response is expressed as a function of linear combinations of explanatory variables through the link function

$$\eta_i = x_i'\beta = g(\mu_i) \quad (7)$$

where $g(.)$ is the link function and the inverse of the link function, $\mu_i = g^{-1}(x_i'\beta)$ is the mean function.

Other features are the distribution of the dependent variables and the robustness of inference to the choice of distributions (Lee and Nelder, 1996, 2001; Lindsey, 1997; McCullagh and Nelder, 1989; Nelder and Wedderburn, 1972; Jong and Heller, 2008; Frees, 2010). Since the linear model was based on normal distribution theory, preliminary results suggested that the responses (total healthcare costs, cost of drugs, consultancy costs and medical expenses) were not normally distributed. This makes linear models ineffective for statistical inference procedures. The proposal is, therefore, based on the linear exponential family distribution of the response variable in the form:

$$f(y;\theta,\emptyset) = \exp\left(\frac{y\theta - b(\theta)}{\emptyset} + S(y,\emptyset)\right) \quad (8)$$

where y is a dependent variable and θ is the parameter of interest. The quantity $\emptyset$ is a scale parameter. The term $b(\theta)$ depends only on the parameter θ; not on the dependent variable. $S(y,\emptyset)$ is a function of the dependent variable and the scale parameter. The log-likelihood is

$$\ln f(y) = \sum_{i=1}^{n}\left\{\frac{y_i\theta_i - b(\theta_i)}{\emptyset_i} + S(y_i,\emptyset_i)\right\} \quad (9)$$

Using the canonical links gives equality between the distribution's parameters and systematic components so that $\theta_i = \eta_i = x_i'\beta$ (Jong and Heller, 2008). Thus, with $\phi_i = \emptyset/w_i$, where w_i is a known weight, the log-likelihood becomes: $L(\beta,\emptyset) = \ln f(y) =$

$$\sum_{i=1}^{n}\left\{\frac{y_i x_i'\beta - b(x_i'\beta)}{\emptyset/w_i} + S(y_i,\emptyset/w_i)\right\} \quad (10)$$

Differentiating partially, with respect to parameters β, yields the score function

$$\frac{\partial}{\partial\beta}L(\beta,\emptyset)=\frac{1}{\emptyset}\sum_{i=1}^{n}\left(y_i-b'(x_i'\beta)\right)w_ix_i \quad (11)$$

since $\mu_i=b'(\theta_i)=b'(x_i'\beta)$, the maximum likelihood estimators of β, b_{MLE} is obtained through the normal equations

$$\sum_{i=1}^{n}w_i(y_i-\mu_i)x_i=0 \quad (12)$$

The maximum likelihood estimator can be computed using iterated, re-weighted least squares methods (McCullagh and Nelder, 1989). The inference for b_{MLE} is robust *vis-a-vis* the choice of distributions.

Goodness-of-Fit Statistics

A widely cited goodness-of-fit measure is the Pearson chi-square, defined as $\sum_i(y_i-\hat{\mu}_i)^2/\emptyset v(\hat{\mu}_i)$. General information criteria include the Alkaike Information Criterion (AIC)

$$AIC=-2\times L(b_{MLE})+2k \quad (13)$$

and Bayesian Information Criterion (BIC)

$$BIC=-2\times L(b_{MLE})+kln(k) \quad (14)$$

Results and Discussion

Tables 3 and 4 summarise the response variables across the sample characteristics, using descriptive statistics. Table 3 shows a clear difference between the mean and median of total costs across selected socio-econo-demographic and insurance coverage characteristics. In all cases, the mean medical expenditures were higher than the median. Similarly, same indications were observed on the costs of drugs and consultancies, and medical expenses.

From the exploratory data analysis results displayed in Table 5, it can be seen that there was a high positive skewness and heavy tailed kurtosis for all the explanatory variables. The total costs had a skewness of 7.74, kurtosis of 83.84 and coefficient of variation of 192%. For the cost of drugs, the skewness, kurtosis and coefficient of variation were 8.28, 92.24 and 267%, respectively, whereas the skewness of cost of consultancies was 10.96 with a kurtosis of 178.73 and coefficient of variation of 232%. The medical expenses had a skewness of 9.83, a kurtosis of 138.69 with coefficient of variation of 157%. These can be observed from the histograms and Box and Whisker plots shown in Figure 3. The preliminary exploratory data analysis results indicate that the healthcare costs are heavily tailed and highly peaked, suggesting the suitability of generalised linear modelling.

Table 6 displays the generalised logit regression for the determinants of health insurance coverage. The results presented suggest that the fitted generalised logit regression model is significant with Hosmer and Lemeshow test statistic of 25.618 and a p-value of 0.001. The Nagelkerke R-square of 0.796 was a good goodness-of-fit indicator for the simulated model.

Employment and income are significant determinants amongst individuals and households characteristics at 90% confidence level. Although self-employment is shown to contribute negatively, private employment contributes positively to health insurance coverage. The regular use of prescription drugs was the only significant determinant for the health maintenance characteristics. Also, health insurance characteristics (insurance coverage, awareness, benefits and policy affordability) are all significant and influence the possession of health insurance coverage negatively. Consequently, socio-econo-demographic, healthcare costs and insurance characteristics are significant determinants of health insurance coverage.

Table 3: Average Total Costs by Explanatory Variables

Variable	Description	Total Cost (₦)	
		Mean	Median
Gender	Male	58695.67	30000.00
	Female	57749.93	36000.00
Age		58518.83	32000.00
Marital Status	Single	60427.71	33000.00
	Married	57477.97	30000.00
	Divorced	62608.33	31500.00
	Separated	39574.51	21000.00
Education	Ph.D./Master's	66311.71	40000.00
	B.Sc./HND	50408.13	27500.00
	ND/NCE	48771.79	26000.00
	SSCE/WASCE	106086.90	44500.00
	Others	45078.03	20000.00
Religion	Christianity	61487.43	35000.00
	Islam	52491.05	26000.00
	Traditional	92287.50	39350.00
	Others	51404.55	45000.00
Employer	Self	60449.05	30000.00
	Private	58293.67	36750.00
	Government	55926.17	29500.00
Income compared to Poverty line	High	59887.69	42000.00
	Middle	60076.43	31200.00
	Low	56969.88	33475.00
	Near poor	23000.00	13500.00
Insurance Coverage	Yes	81074.64	44000.00
	No	48085.92	26000.00
Health Insurance Coverage	Yes	83324.54	45000.00
	No	48270.45	26000.00

The modelling and testing of hypothesis II results are presented in Tables 7–10. Results for the full and reduced models for total healthcare costs, using generalised normal and γ-regressions are presented in Table 7. It is evident from the results that the fitted models are adequate and suitable for testing the effect of socio-econo-demographic, health insurance and

Table 4: Average Medical Expenditures by Explanatory Variables

Variable	Description	Cost of Drugs (₦)		Cost of Consultancies (₦)		Medical Expenses (₦)	
		Mean	Median	Mean	Median	Mean	Median
Gender	Male	44178.59	15000.00	9804.39	2750.00	19599.99	12000.00
	Female	41569.58	20000.00	9160.23	30000.00	18379.00	12000.00
Age		43339.67	18000.00	9614.30	3000.00	19167.86	12000.00
Religion	Christianity	43333.54	24000.00	12067.00	4000.00	19961.02	14000.00
	Islam	44093.69	10000.00	5688.17	3600.00	12000.00	44437.50
	Traditional	25500.00	19345.00	1850.00	15136.36	7000.00	18681.82
	Others	17500.00	43236.37	12500.00	9584.85	12250.00	19188.43
Marital status	Single	43521.34	24000.00	11558.89	4200.00	18648.91	10000.00
	Married	44247.49	8500.00	7788.78	1500.00	19476.88	15000.00
	Divorced	48277.78	3000.00	7025.00	1500.00	19375.00	15000.00
	Separated	24793.00	4500.00	4515.69	1500.00	21816.33	15000.00
Education	Ph.D./Master's	25664.22	15000.00	19267.67	10000.00	25287.41	15000.00
	B.Sc./HND	45050.44	15000.00	6303.03	1500.00	19408.59	15000.00
	ND/NCE	41878.35	20000.00	2875.21	1500.00	11176.92	6000.00
	School Cert.	110531.43	36000.00	5946.15	3000.00	8878.75	5000.00
	Others	16526.88	5000.00	17532.11	6000.00	18639.25	12000.00
Income compared to Poverty line	High	40655.93	24000.00	12134.92	5000.00	11959.02	7000.00
	Middle	41167.73	15000.00	10360.30	2500.00	22720.07	15000.00
	Low	47128.20	24000.00	8109.85	3000.00	15048.96	10000.00
	Near poor	43500.00	42000.00	2571.43	1000.00	7000.00	5000.00
Employer	Self	56407.59	20000.00	6282.65	2000.00	19634.55	12000.00
	Private	37117.34	24000.00	12870.71	5000.00	18018.31	10000.00
	Government	38249.85	5000.00	8986.94	1500.00	20228.16	15000.00
Insurance Coverage	Yes	47734.17	20000.00	19161.48	10000.00	22434.53	15000.00
	No	40535.85	12000.00	5208.08	1500.00	17706.81	12000.00
Health Insurance Coverage	Yes	46438.77	20000.00	19949.14	10000.00	22446.69	15000.00
	No	41355.29	12000.00	5403.72	1500.00	17853.72	12000.00

healthcare costs characteristics on total OOP expenses. This is supported by the likelihood ratio test results of 75.512 and 187.827, with p-value of 0, for the reduced models under normal and γ-fittings, respectively. Similarly, the log-likelihood, AIC, BIC and Consistent AIC model performance evaluation criteria are displayed in Table 7, indicating that the parsimonious generalised γ is the best simulated model with 7 significant determinants. The full generalised γ model and reduced normal generalised regression have 5 significant determinant loadings.

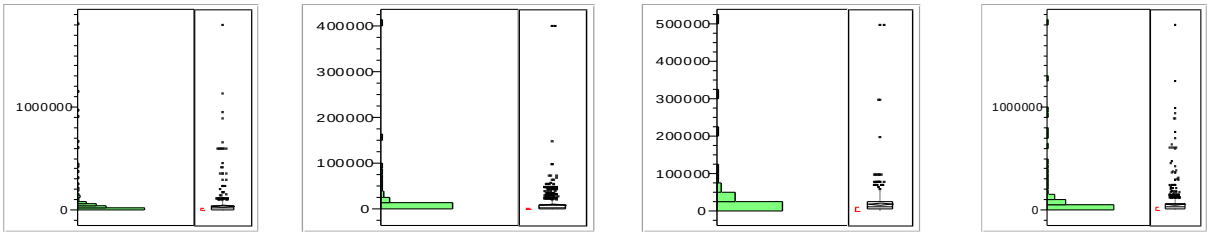
It is important to note that the generalised linear model with 21 covariates has only 2 significant determinants (number of children and affordability of drugs). This is in agreement with the preliminary exploratory results underlining the weaknesses of the normality assumptions. From the best simulated model, the number of children, employers and income are significant socio-economic determinants; insurance coverage and benefits from NHIS are the health insurance contributors while consultation of care provider and affordability of prescription drugs are the significant health maintenance determinants. For in-depth analysis, each of the 3 constituents of total OOP expenses, costs of drugs and consultancies, and medical expenses are evaluated, using the generalised normal and γ-regression.

The results of the full and reduced models for the cost of drugs are presented in Table 8. It shows that the fitted models are adequate and suitable for testing the hypothesis, using the goodness-of-fit performance evaluation criteria. The generalised γ-regression demonstrated consistent and better performance over the generalised linear model. Of the 21 covariates, 11 significant determinants were included in the reduced simulated model while 9 were significant for the full model. Income, number of children, employers and age were significant socio-economic determinants; health insurance benefits, knowledge of and benefits from NHIS are the significant health insurance characteristics while consultation with care provider, cost of consultancies, frequency of utilisation of drugs and affordability of prescription drugs are the significant health maintenance determinants for the cost of drugs.

The fitted generalised models under normal and γ-link functions for the full and reduced models, with 21 covariates results for cost of consultancies, are presented in Table 9. It is evident from the goodness-

Table 5: Descriptive Statistics of Out-of-pocket (OOP) Expenditures

Quantiles	Cost of Drugs (₦)	Cost of Consultancies (₦)	Medical Expenses (₦)	Total Costs (₦)
100.00%	1800000	400000	500000	1806000
99.50%	905400	90720	173000	900000
97.50%	327000	50000	70000	273750
90.00%	72000	26000	45000	125000
75.00%	45000	9375	25000	59000
50.00%	18000	3000	12000	32000
25.00%	4000	1000	5000	15500
10.00%	2000	700	3000	8000
2.50%	1000	645	2000	2000
0.50%	50	500	1000	0
Moments				
Mean	43236.37	9584.847	19188.43	58372.4
Std. Dev.	115589.8	22246.46	30055.98	112080.7
Std. Err. Mean	4136.128	680.7305	926.2255	3379.359
Upper 95% Mean	51355.63	10920.57	21005.89	65003.13
Lower 95% Mean	35117.11	8249.125	17370.97	51741.68
Skewness	8.278993	10.95674	9.831205	7.737068
Kurtosis	92.23537	178.7337	138.6872	83.8461
CV	267.3439	232.1003	156.636	192.0097



Cost of Drugs **Cost of Consultancies** **Medical Expenses** **Total Costs**

Figure 3: Distributions and Box Plots of Medical Expenditures

Table 6: Generalised Logit Regression for Health Insurance Coverage

Variables	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Constant	10.422	2.172	23.026	1	0	33586.378		
Employer			5.815	2	0.055			
self	–1.414	0.862	2.691	1	0.101	0.243	0.045	1.317
private	0.576	0.699	0.678	1	0.410	1.778	0.452	6.997
Income	1.59×10^{-7}	9.20×10^{-8}	3.000	1	0.083	1.000	1.000	1.000
Insurance Coverage	–3.274	0.629	27.067	1	0	0.038	0.011	0.130
Awareness (yes)	–4.070	1.003	16.453	1	0	0.017	0.002	0.122
Health Insurance Benefit			26.863	2	0			
Yes	–4.845	0.968	25.066	1	0	0.008	0.001	0.052
No	–2.980	1.067	7.804	1	0.005	0.051	0.006	0.411
Current Policy Description			9.550	2	0.008			
affordable	–2.345	0.861	7.412	1	0.006	0.096	0.018	0.519
cheap	–0.704	0.997	0.498	1	0.480	0.495	0.070	3.491
Prescription Drugs Usage			14.582	2	0.001			
always	–2.617	0.698	14.056	1	0	0.073	0.019	0.287
never	0.645	1.559	0.171	1	0.679	1.906	0.090	40.487
Goodness of Fit								
–2 Log likelihood	97.942							
Cox & Snell R Square	0.582							
Nagelkerke R Square	0.796							
Hosmer and Lemeshow Test	25.618	0.001						

of-fit tests that the models were appropriate for modelling and testing the determinants of the cost of consultancies. The reduced generalised γ-regression had 9 significant determinants while the reduced

Table 7: Generalised Linear Models for Total Healthcare Costs

Variables	Generalised Normal Regression				Generalised Gamma Regression			
	Full Model		Reduced Model		Full Model		Reduced Model	
	B	p-value	B	p-value	B	p-value	B	p-value
(Intercept)	2.74×10^5	0.003	1.75×10^5	0	13.17	0	12.606	0
Gender	-1.67×10^4	0.389			–0.25	0.048		
Age	–119.30	0.914			–0.01	0.266		
Religion	–7836.91	0.619			–0.07	0.561		
Marital Status	4520.98	0.785			0.03	0.815		
Number of Children	25286.12	0.003	10883.08	0.001	0.18	0.001	1.10×10^4	0
Education	–1581.95	0.849			–0.07	0.259		
Employer	–16735.26	0.225	-1.24×10^4	0.018	–0.10	0.243	1.35×10^4	0.009
Income	0.003	0.074	0.002	0.068	2.91×10^{-8}	0.004	0.002	0.066
Income compared to Poverty line	10055.75	0.535			0.05	0.633		
Insurance Coverage	–6657.79	0.766			–0.22	0.146		
Insurance Awareness	-3.45×10^4	0.223			–0.22	.247		
Health Insurance	-1.10×10^4	0.722			–0.22	0.279	-3.87×10^4	0
Health Insurance Benefit	–4949.49	0.731			–0.07	0.482		
Policy Description	–4916.24	0.724			0.05	0.610		
Knowledge	39965.58	0.097	15148.78	0.158	0.31	0.050	2.10×10^4	0.047
Benefited from NHIS	-2.86×10^4	0.160	-3.74×10^4	0.001	–0.20	0.141	-2.75×10^4	0.020
Consultation of Care Provider	–832.44	0.975			0.24	0.207		
Rating of Healthcare Costs	6759.39	0.699			0.06	0.588		
Who pays Health Bill	-2.24×10^4	0.107			–0.17	0.080		
Frequency of use of Prescription Drugs	–7370.93	0.491	12782.49	0.006	–0.02	0.803		
Affordability of Prescription Drugs	-3.68×10^4	0.005	-3.39×10^4	0	–0.37	0	-3.03×10^4	0
Goodness-of-Fits								
Log Likelihood	–3049.021		–6842.336		–2805.236		–6838.182	
AIC	6124.055		13702.671		5654.472		13694.364	
BIC	6217.788		13741.144		5730.014		13732.837	
Consistent AIC	6239.788		13750.144		5752.014		13741.837	
Likelihood Ratio	44.066	0.001	75.512	0	86.061	0	83.819	0

normal regressiona selected 5 out of the covariates. Thus, for cost of consultancies, age and education were the significant socio-demographic determinants; insurance coverage was the only significant health insurnce characteristic; while cost of drugs, benefits from NHIS, rating of healthcare cost, payer of health bills, medical expenses, frequency of utilisation of drugs and affordability of prescription drugs were the significant health maintenance characteristics for cost of consultancies under the best simulated model.

Table 10 presents the results for the full and reduced models for medical expenses, using generalised linear models, with normal and γ-links. The likelihood ratio statistic of 195.23 and 846.88, with p-value of 0 and log-likelihood of –2374.86 and –11700.97 for the reduced simulated models under gamma and normal fittings, respectively, gave a good representation of the medical expenses. The BIC and Consistent AIC model performance criteria were also displayed in Table 10. Age, marital status and income relative to the poverty line were significant socio-economic determinants; insurance awareness and policy descriptors are health insurance contributors whereas consultation of care provider, rating of healthcare costs, payer of health bills, cost of consultancies, frequency of utilisation of prescription drugs and affordability of prescription drugs are the significant health maintenance characteristics for the medical expenses at a 95% confidence level.

Conclusion

The study critically investigated, empirically, the determinants of OOP healthcare expenses in Nigeria. The article specifically focused on how households' OOP expenses relate to socio-econo-demographics,

Table 8: Generalised Linear Models for Cost of Drugs

Variables	Generalised Normal Regression				Generalised Gamma Regression			
	Full Model		Reduced Model		Full Model		Reduced Model	
	B	p-value	B	p-value	B	p-value	B	p-value
(Intercept)	142466.13	0.120	119667.49	0.005	10.79	0	9.81	0
Gender	–9483.43	0.611			–0.13	0.438		
Age	6.83	0.995			–0.02	0.011	–0.02	0.022
Religion	–4447.99	0.768			–0.07	0.602		
Marital Status	2523.79	0.874			0.11	0.518		
Number of Children	24147.30	0.003	18143.42	0	0.22	0.001	0.25	0
Education	3364.95	0.672			0.04	0.659		
Employer	–17172.18	0.190	–20482.43	0.003	–0.14	0.214	–0.24	0.002
Income	2.52×10^{-3}	0.080	1.98×10^{-3}	0.072	2.24×10^{-8}	0.029	1.73×10^{-8}	0.038
Income compared to Poverty line	15759.16	0.324			0.22	0.124		
Insurance Coverage	7253.35	0.738			0.01	0.980		
Insurance Awareness	–26794.90	0.338			–0.07	0.774		
Health Insurance Benefit	1643.04	0.906			0.21	0.092	0.45	0
Policy Description	–5649.27	0.675			0.01	0.925		
Knowledge	38558.12	0.095			0.48	0.018	0.30	0.044
Benefited from NHIS	–43187.69	0.030	–37681.71	0.007	–0.53	0.003	–0.71	0
Consultation of Care Provider	15126.50	0.578	34411.75	0.028	0.69	0.003	0.83	0
Rating of Healthcare Costs	10084.51	0.549			0.09	0.504		
Who pays Health Bill	–24872.93	0.073			–0.38	0.002		
Cost of Consultancies	0.69	0.296	1.07	0.001	2.42×10^{-5}	0.003	4.89×10^{-5}	0
Medical Expenses	0.56	0.467			7.72×10^{-6}	0.355		
Frequency of use of Prescription Drugs	–8134.76	0.460			0.06	0.555	0.36	0
Affordability of Prescription Drugs	–28113.30	0.028	–24435.36	0	–0.38	1.12×10^{-3}	–0.47	0
Goodness-of-Fits								
Log Likelihood	–2929.98		–4576.52		–2590.427		–3888.265	
BIC	5989.73		9205.83		5310.626		7852.721	
Consistent AIC	6013.73		9214.83		5334.626		7865.721	
Likelihood Ratio	52.93	0	67.84	0	149.155	0	264.203	0

insurance and health maintenance characteristics. The exploratory survey research method was employed to meet the research objectives and ascertain the veracity of the formulated hypotheses. Generalised linear models were fitted to determine the causal factors of OOP expenses and households' choice of health insurance.

It was found that while income contributed positively to health insurance coverage, the regular use of drugs indirectly influenced it. Insurance coverage, policy affordability, awareness and benefits were significant and negatively caused the possession of health insurance coverage. Total healthcare costs were directly influenced by family size, income and consultation of care provider; employer, insurance coverage, affordability of prescription and benefits from NHIS drugs indirectly influenced total healthcare costs. For the cost of drugs, age, employer, benefit from NHIS and affordability of prescription drugs were the main indirect determinants while family size, income, knowledge about insurance, health insurance benefits, consultation with care provider, cost of consultancy and frequency of utilisation of prescription drugs directly contributed to the costs of drugs. In the case of the cost of consultancies, age, education, insurance coverage and the affordability of prescription drugs contributed negatively. The cost of drugs, rating of healthcare costs, payment of health bills responsibility, medical expenses and frequency of the utilisation of prescription drugs were direct determinants for the cost of consultancies.

For medical expenses, the direct contributors were: age, marital status, income compared to poverty line, cost of consultancies and affordability of prescription drugs whereas the negative significant determinants

Table 9: Generalised Linear Models for Costs of Consultancies

Variables	Generalised Normal Regression				Generalised Gamma Regression			
	Full Model		Reduced Model		Full Model		Reduced Model	
	B	p-value	B	p-value	B	p-value	B	p-value
(Intercept)	18049.386	0.051	2134.985	0.474	9.585	0	8.995	0
Gender	–2025.724	0.283			–0.129	0.280		
Age	–331.331	0.002			–0.024	0	–0.014	0.001
Religion	47.701	0.975			0.039	0.681		
Marital Status	–3903.396	0.014			–0.130	0.208		
Number of Children	966.810	0.253			0.078	0.131		
Education	–1058.718	0.188			–0.167	0	–0.113	0
Employer	1045.876	0.432			–0.044	0.621		
Income	-2.079×10^{-5}	0.887			-1.0×10^{-8}	0.240		
Income compared to Poverty line	–4377.444	0.006			–0.270	0.006		
Insurance Coverage	–4053.118	0.063	–6252.894	0	–0.285	0.051	–0.476	0
Insurance Awareness	6510.724	0.020			0.255	0.140		
Health Insurance Benefit	–1499.688	0.287			–0.144	0.124		
Policy Description	2126.986	0.117			–0.069	0.385		
Cost of Drugs	0.007	0.296			7.36×10^{-7}	0.108	1.936×10^{-6}	0
Knowledge	504.994	0.830			0.139	0.347		
Benefited from NHIS	–1605.109	0.429			0.328	0.013		
Consultation of Care Provider	1285.587	0.641			0.069	0.693		
Rating of Healthcare Costs	2606.036	0.124			0.297	0.002	0.101	0.040
Payer of Health Bills	3192.476	0.022	4465.025	0	0.200	0.038	0.285	0
Medical Expenses	0.791	0	0.517	0	3.68×10^{-5}	0	3.321×10^{-5}	0
Frequency of use of Prescription Drugs	5361.411	0	5169.928	0	0.405	0	0.468	0
Affordability of Prescription Drugs	–3290.691	0.011	–2699.715	0	–0.317	0	–0.294	0
Goodness-of-Fits								
Log Likelihood	–2419.531		–11345.67		–2262.93		–7409.853	
BIC	4968.834		22739.927		4655.63		14892.512	
Consistent AIC	4992.834		22746.927		4679.63		14903.512	
Likelihood Ratio	183.806	0	949.541	0	185.348	0	579.564	0

were: frequency of utilisation of prescription drugs, insurance awareness, policy description, consultancy of care provider and the payment of health bills responsibility. These findings suggest a strong presence of moral hazard and adverse selection in the healthcare system. This, therefore, calls for a risk adjusted capitation regime based on households' risk profiling. Since the goal of NHIS is universal health coverage, where every Nigerian is expected to access necessary health services, without suffering financial

Table 10: Generalised Linear Models for Medical Expenses

Variables	Generalised Normal Regression				Generalised Gamma Regression			
	Full Model		Reduced Model		Full Model		Reduced Model	
	B	p-value	B	p-value	B	p-value	B	p-value
(Intercept)	8199.57	0.305	31220.98	0	9.75	0	9.98	0
Gender	388.56	0.811			0.04	0.672		
Age	263.10	0.004			0.02	0.001	0.01	0.008
Religion	–967.81	0.459			–0.03	0.750		
Marital Status	3901.11	0.004			0.25	0.002	0.23	0.002
Number of Children	–661.81	0.362			–0.07	0.130	–0.04	0.401
Education	319.54	0.644			–0.04	0.386		
Employer	–997.13	0.382			–0.04	0.521		
Income	5.57×10^{-5}	0.658			-8.45×10^{-9}	0.287		
Income compared to Poverty line	2351.86	0.089			0.12	0.184	0.17	0.044
Insurance Coverage	741.56	0.694			0.02	0.878		
Insurance Awareness	–6591.14	0.006			–0.63	0	–0.51	0
Health Insurance Benefit	213.96	0.860			–0.02	0.808		
Policy Description	–1568.97	0.179			–0.12	0.105	–0.15	0.032
Cost of Drugs	4.23×10^{-3}	0.467			1.05×10^{-7}	0.767		
Knowledge	–1361.62	0.500			–0.09	0.476		
Benefited from NHIS	3127.72	0.071			0.18	0.072		
Consultation of Care Provider	–3613.03	0.125	–9466.95	0	–0.36	0.010	–0.51	0
Rating of Healthcare Costs	–2532.68	0.081			–0.17	0.070	–0.17	0.072
Payer of Health Bills	–1682.96	0.164	–5803.88	0	–0.12	0.083	–0.19	0.004
Cost of Consultancies	0.58	0	1.03	0	3.16×10^{-5}	0	3.07×10^{-5}	0
Frequency of use of Prescription Drugs	–4565.25	0	–6699.09	0	–0.33	0	–0.34	0
Affordability of Prescription Drugs	1921.44	0.086	3314.32	0	0.13	0.053	0.16	0.007
Goodness-of-Fits								
Log Likelihood	–2385.34		–11700.97		–2364.21		–2374.86	
BIC	4900.46		23450.52		4815.49		4825.97	
Consistent AIC	4924.46		23457.52		4831.49		4839.97	
Likelihood Ratio	189.74	0	846.88	0	196.59	0	195.23	0

hardship, the healthcare scheme should make provision for deliberate strategies to cushion the burden of OOP expenses. This will ensure adjustment pooling mechanisms that minimise risk selection.

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