Nepal Journal of Mathematical Sciences (NJMS)
ISSN: **2738-9928 (*online*), 2738-9812 (*print*)**
Vol. 2, No. 2, 2021 (August): 97-112
DOI: https://doi.org/10.3126/njmathsci.v2i2.40129

Research Article
Received Date: March 18, 2021
Accepted Date: August 20, 2021
Published Date: August 30, 2021

Mathematical Techniques of Modelling Salary-Based Health Care Contribution

Ogungbenle Gbenga Michael

Department of Actuarial Science, *Faculty of Management Sciences*,

University of Jos, *Nigeria.*

Email: *moyosiolorun@gmail.com*

Abstract:*This paper is intended to support reforms counteracting the adverse health insurance contribution trends through constructing an actuarially equitable salary-based health care system for experienced health insurance underwriters. The focus is on contribution technique employed by experts who consult for health insurance funds especially when performing official duties as health insurance actuary. The objective is to construct actuarial models of computing employee's, employer's and government's contribution for health insurance care program in a way that permits generally equitable cost-efficient health insurance coverage within the framework of obtainable health benefits policy. Nigeria's low economic growth rate and primitive technology resulted in an increasing rate of health care costs and consequently, quality health care at affordable prices is far from the reach of enrollees because of inequitable distribution of costs. In order to solve this problem, we constructed a health care model with a deterministic salary function structure to compute contribution on behalf of enrollees as a paradigm shift to an actuarial system of modelling contribution with a goal to building a sustainable health insurance delivery that encourages good health outcomes. From our results, the rate derived from our current model is far below the official rating of* 1.75% *on employee's salary which is not footed on actuarial basis and hence cheaper and more equitable to adopt.*

Keywords: *Contribution*, *Estimation*, *Enrollee*, *Health care*

1. Introduction

The national health insurance scheme is financed through insurable income earnings subjected to contribution rating defined at law. Following the social reforms driven towards revamping the economy with free-market, Nigeria has commenced drastic action in improving her health insurance system. Following Wagstaff & Van Doorslaer (2010), Wagstaff (2010), Odeyemi & Nixon (2013) and NHIS[Nigeria], the national health insurance scheme is intended to perform as public-private initiative to provide an affordable health care scheme. The main focus of the national health insurance scheme remains to shield enrollees from the excruciating financial burdens of medical bills. Furthermore, it is also intended to secure an equitable distribution of medical cost among numerous employees while still maintaining quality health service delivery. The national health insurance health sector faces critical problem of evolving sustainable contribution rate regime because of critical health information content deficits ravaging the health insurance system. The basic objectives of the national health scheme have not been attained because of harsh pricing policies resulting in adverse & risk selection and unreasonable health insurance cost practices. As observed in (Ramjee *et al*., 2014), there are measurable pressures on both health insurance program and their actuarial advisors to improve the health insurance scheme costing procedures. Furthermore, there is political pressure that emerges from the paradigm shift in health policy

although it remains uncertain which policy dimension is being taken for health insurance schemes under national health insurance regulations.

Health financing structure presently lacks requisite data content to address empirical-based decision-making process, cost-effective analysis, health insurance data profile, user fees and transaction costs. In Odeyemi & Nixon (2013), certain pressures which are responsible for the introduction of national health insurance scheme are as follows: too much reliance on government-owned health facilities, increased costs in health care in the presence of poor funding and the dying state of the health care services. Consequently, many cost-containment measures based on out of pocket payments were formulated in conjunction with a growth in the privatized health insurance services. In Intan *et al.* (2016), the out of pocket financing as a broad means of health insurance services financing in low-income economies evolve while treatments are paid for directly by enrollees for the services utilized. As was further observed in Odeyemi & Nixon (2013), the import of national health insurance scheme is to eliminate if possible relying heavily on out on pocket user charges. Recently, the sharp increases in health insurance scheme costs in Nigeria have progressively exceeded the inflation rate thereby exerting much pressure on accessibility. The rising share of public costs on health with growing earning levels result in high-risk pooling vides contributions for the compulsory national health insurance program. The share is often associated with the national socio-economic growth in tandem with financial and labour markets.

As observed in Tao (n.d) and Barber, *et. al*. (2019), some assumptions are required in pricing health insurance policies among which are morbidity, risk margin, expense and profit margin but morbidity is the more important than others. Faden *et al* (2011) stated that, morbidity is the incidence and severity of sickness in a defined class of people. Thus we can infer from the authors that morbidity which ordinarily refers to the probability of being diseased is the amount of financial loss incurred by the enrollees which are associated with the state of illness. There are two types of data required in pricing policies of health insurance: Internal and external data. The external data is incapable of providing the required information content needed in computing contribution because of varying bases of observation. The internal data is restricted in form as a result of transient historical profile $\alpha(\tau)$ at a time τ for numerous Nigerian underwriters to manage health insurance scheme. Consequently, in an emerging economy, consulting actuaries working in the health area have to use external data. In Tao (n.d), it was reported that morbidity and health cost data from the first and second National Investigation of Health Service in 1993 and 1998 were used by some actuaries to estimate the expected hospitalization rate and establish other actuarial assumptions for many years. Until recently, most health underwriting firms in Nigeria have not gotten actuaries to carry out actuarial analysis of health claim data associated with their health insurance business. As a result, the Nigerian underwriting health actuaries if any seem unable to formulate assumptions concerning insurance data and consequently are compelled to use external data.

Following Tao (n.d), there are four core requirements usually considered in pricing policies: Equity, reasonability, competitiveness and adequacy. Because of restricted data and inexperience, it seems the Nigerian health insurance providers stress the principle which suits them most. Rate adequacy observes that a feasible projection of losses and cost be embedded in the pricing decision. A small price could offer the insurer a competitive advantage at the short run but could negatively impact on the capital requirement of the insurance activities at the long run. Thus adequacy requirement is essentially to reduce the risk of insolvency and ruin of insurance firm by avoiding ridiculously ambiguous pricing competition. In order to keep the amount of contribution sufficient to cover benefit reimbursement and administrative cost, a conservative rating evolved. Rate reasonability observes that a level of reasonability in profit margin is expected by the Nigerian insurance firm. In order to ascertain the rate adequacy, the Nigerian health underwriter usually establishes a pricing regime which far exceeds the expected losses and cost. However, this ambiguous rating may not be extremely continuous due to market competition and consequently in the near absence of competition in estimating health rate, the excessive rate could tend to have negative effect on the demand for health insurance cover by enrollees. In the Nigerian health sector, enrollees seem hard to evaluate because the benefits received do not seem to commensurate with the contribution paid. Health underwriters stress the principle of reasonability and consequently, enrollees

complain about the unbearable cost of health care services in Nigeria. Though competitiveness differs from the norm in other advanced economies, health care costs are significantly higher than insurances of similar cover. In Intan *et al*. (2016), many equity-related issues were reported to have arisen particularly with respects to health care services, health care funding, utilization of health care, privatization and the role of government for equity in health care. Therefore, regulators should ensure the successful equity achievement in health care and sound health administration structure. They should also define iterative techniques for core players in health care since health policy operates in the broad political spectrum.

Rate equity describes the fair treatment of every enrollee. Health insurance contributions will be unfair as the enrollees are excessively billed for the loss exposure as compared to another loss of similar exposure pedigree. Since the Nigerian underwriters would usually cite reasons justifying her pricing policy, the requirement seems quite subjective unless social equity applies. For the principle of equity however, health care cost is different for people with varying socio-economic status. The basic procedure in health care cost is to ***project*** the amount of claim reimbursed. The annual claim cost, the risk premium constitutes the product of frequency which is the probability of the claim occurring and the magnitude of average severities representing the expected amount of claim. The severity represents the average amount of loss and thus constitutes the continuance table. The net premium is the sum of risk premium and safety loadings which could provide coverage for the unexpected benefits reimbursed. There are other markups that are added to the net premium to establish the final contribution of the health care arriving at gross contribution to ease out the computation. In practice, in order to prevent conditions where severity is greater than the expected claim by much difference, contingency margin in form of safety loading l usually within the interval $0.3 \le l \le 2$ is applied to the risk premium to estimate the final contribution of enrollees. According to Tao (n.d), when costing a life-long health insurance scheme, a level premium rate basis is applied. Health actuaries apply the technical rate of interest to establish cash value of contribution income and claim cost when computing the level premium. Actuaries compute the current benefits and whole benefits to the end of the contract. Further assumptions like mortality, interest, lapse rate and trend factor are applied. Lapse rate could be significantly applied in long-life health insurance products since the probability of lapse depends on an assumption of persistency rating, the assumption should rather be based on the underwriter's assumption.

When costing group health insurance scheme, health actuaries establish three basic types of ratings which are found in Tao (n.d) as: the manual rating, blended rating and experience rating to set up the contribution levels. The manual rating which can be adjusted by health status factor is a function of the expected benefits payments useful for a small population of enrollees usually within 50. Individual health insurance rates changes with age and sex and are underwritten such that the health status examined by the past health condition of the scheme holder are applied to establish the rate according to the health risk of the individual. The manual rate is first computed to estimate the contribution considering the age and sex of the enrollees, location, number of enrollees and the type of health insurance product. However, where the population of enrollees tend to be large say above 50, then the experience rating is applied and the enrollees' contribution rate obtained either from an individual group's medical claims profile known as experience rating. The blended premium is a mixture of claim experience of the enrollees together with the expected risk levels of all population. Health insurance contribution rating is an actuarial projection of the cost of covering the risk exposure of individual enrollees under defined health benefits for a specified time interval. In the same way as contribution rate should be enough to pay for the expected health insurance usage, they should further be adequate to reimburse insurance carriers for carrying on the financial risk connected with the provision of the cover. The final contribution rate estimation is often reviewed to include many other parameters such as satisfying previous financial loss and funding excess capital to manage numerous risks regulated at law under national solvency benchmarks. Regulations adopt solvency benchmarks to shield enrollees by imposing them on health insurance firms to maintain particular reserve level of capital to insure against asset risks and underwriting risk. A health insurance firm with no secured reserve may be insolvent if it experiences sudden losses thus leading her enrollees to be exposed to full financial risk for their medical claims. The contribution imposed by health insurance firm is the projected sum which would be needed to cover the following basic areas: (i) the average cost of health benefits covered (ii) the administrative costs of managing the cover and (iii) a profit margin consistent with the strategic business goal of the firm and (iv) upward or downward review to include many other variables such as responding to prior gains or losses, responding to competitors, hedging

against uncertainty risks as a result of changing regulatory environment and other variables globally defined as the underwriting cycle. In Newsom & Fernandez (2011), the health insurance underwriting cycle describes the likelihood for health insurance contribution and insurer's profitability to cycle over a defined time horizon. Health insurance premiums are contractual amount of contributions payable for a specific range of health benefits within a specified period usually a year. Contributions are usually paid in monthly installments by individual scheme holders and enrollees. As observed in Newsom & Fernandez (2011), Burtless & Milusheva (2013), contributions are of varying degree for different enrollees with similar health benefits from the same insurance company. Each level of variation will then constitute a contribution rate.

The estimation of the initial contribution rate is not the final health insurance level because the rating adjustment procedure is a looping which repeats itself periodically. The pricing of private health insurance is fraught with challenging issues such as information asymmetries, management of anti-selection, moral hazard, uncertainties, risk aversion and regulation. Following American Academy of Actuaries [AAA] (2008), the higher the percentage of eligible employees enrolled in a health insurance scheme, the more improved the risk mix becomes and the more consistent, easier it is to project the scheme costs. Consequently, health insurers usually need minimum enrollee levels of participation for group coverage usually 80 percent of the qualified enrollees. Health insurance programs devoid of minimum participation criteria would be exposed to adverse selection. A core requirement in the determination to enroll in a health insurance scheme is the premium cost to the enrollee. Health insurance users are price-sensitive and hence participation rates increase when employers contribute more towards premiums. The higher the enrollee's level of contribution, the higher is the probability that individual enrollee electing to enroll is at higher risk of greater health costs and expects to heavily consume the coverage services more. As a result, and to ascertain a consistent risk mix, health insurance scheme carriers usually need minimum employer contribution levels to form part of their underwriting decision.
The national health insurance scheme has been majorly financed by the contributions shared by the enrollees, employer and governments. The contributions received by the National health insurance scheme are used to assist the enrollees to pay for the cost incurred on health-related expenses. For the sake of emphasis, National insurance contributions are solely meant to defray the actual cost of medical expenses. However, the salaries of employees and administrative expenses in relation with any national health insurance program are all borne by the government and under no event is the contribution income employed to cover the costs of these items where applicable.

2. A Review of Actuarial Theory

There are varying techniques of computing contributions. It is necessary to note that each technique has a varying influence on the distribution among health insurance enrollees. Health insurance contributions could be in increasing sequence of complexities, general flat rate, different for specific class of people for instance, small contributions for low salary groups with or without a means test or distinct contributions based on the available salary. The contribution technique includes dependents or it may be required that such dependents have to pay their own contributions which may be equal to or less than those of the employed individual. Contributions that are wholly risk associated and accounting for the member's sex, age profile and past historical records of disease are not applied in the model because such contributions are not a function of capacity to pay but based on the likelihood of being diseased.
The formulation of salary $S(.)$ related contribution is demonstrated as follows. We define the following equation as follows

$$\int_{\tau_0}^{\tau_j} S(s)ds = jh\left[y_0 + \frac{j}{2}\Delta S(\tau_0) + \frac{j(2j-3)}{12}\Delta^2 S(\tau_0) + \frac{j(j-2)^2}{24}\Delta^3 S(\tau_0) + \ldots \right], \qquad (1)$$

$$\tau_j - \tau_0 = jh, j = 1,2,3..$$

Taking $\tau_0 = 0$, then $S(0) = S_0$

$$\int_{\tau_0}^{\tau_j} S(s)ds = jh\left[y_0 + \frac{j}{2}\Delta S(0) + \frac{j(2j-3)}{12}\Delta^2 S(0) + \frac{j(j-2)^2}{24}\Delta^3 S(0) + \ldots \right], \quad (2)$$

The contribution rate is defined as

$$C(\tau) = \frac{\left(B(\tau) + A(\tau) + \Delta\Re(\tau)\right)}{\int S(\tau)d\tau} \quad (3)$$

If we assume that $\int S(\tau)d\tau = \sum_{\tau} S(\tau)$ (4)

$$C(\tau) = \frac{\left(B(\tau) + A(\tau) + \Delta\Re(\tau)\right)}{\sum_{\tau} S(\tau)} \quad (5)$$

then according to Normand *et al.* (2009),

$$\frac{C(\tau)}{100} = \frac{\left(B(\tau) + A(\tau) + \Delta\Re(\tau)\right)}{\sum_{\tau} S(\tau)} = \frac{\left(B(\tau) + A(\tau) + \Delta\Re(\tau)\right)}{\int S(\tau)d\tau} \quad (6)$$

$B(\tau)$ is the cost of benefits, $A(\tau)$ the administrative expense, $\Delta\Re(\tau)$ is the change in reserve while $\sum_{\tau} S(\tau)$ is the sum of total salaries all parameters defined at period τ

$$B(\tau+1) = \left(1+\Delta H(\tau+1)\right)\left(1+\Delta U(\tau+1)\right)\left(1+\Delta E(\tau+1)\right)\left(1+\Delta I(\tau+1)\right)B(\tau) \quad (7)$$

$\Delta H(\tau)$ is the relative change in health care cost in the period τ

$\Delta U(\tau)$ is the relative change in utilization of health insurance services in period τ.

The level of utilization is judged by enrollee's visits, frequency of hospitalization, a quantity of medicine or equivalent measures which include morbidity, prevention and alternative use of health services. Following the American Academy of Actuaries[AAA] (2008), procedures concerning how contributions are measured arise and risk spread over a broad pool influences which employee decides to enrol in a health insurance scheme. At one side of the continuum is the salary based rating technique which charges contributions to every enrollee through the actuarial technique. At the other side of the continuum is the medical underwriting method where groups of enrollees are differentiated based on their expected morbidity levels and their contributions are computed correspondingly.

$\Delta E(\tau)$ is the relative change in the population of enrollees in period τ

$\Delta I(\tau)$ is the relative change in the consumer price index in period τ

Thus the above model in equation (5) could be reformulated using equation (7) as follows

$$\frac{C(\tau)}{100} = \frac{\left[\left(1+\Delta H(\tau)\right)\left(1+\Delta U(\tau)\right)\left(1+\Delta E(\tau)\right)\left(1+\Delta I(\tau)\right)B(\tau-1) + A(\tau) + \Delta\Re(\tau)\right]}{\sum_{\tau} S(\tau)} \quad (8)$$

Following Cichon *et al*. (1999), if $\Delta\Re(\tau)$ is ignored then (1) becomes

$$\frac{C(\tau)}{100} = \frac{\left(B(\tau) + A(\tau) + M(\tau)\right)}{\sum_{\tau} S(\tau)} \quad (9)$$

where $M(\tau)$ is the income from miscellaneous sources other than contributions. The contribution rate $C(\tau)$ defines the total cost of the benefit together with any change in reserves and administrative costs multiplied by 100 and divided by the part of the salary which forms the contribution base. The function $C(\tau)$ is theoretically assumed to cover health benefit pay-out over a defined time interval. For an insurance policy, the real contribution rate obtained within the time interval is computed on a different analytical framework to accommodate safety margin in the event of fluctuating benefit pay-out. The function $C(\tau)$ further describes the financial equilibrium of the system where income and expenditure are theoretically equivalent. Consequently, from the equivalence principle, we have that

$$C(\tau) + \textit{investment income allowance} = \textit{estimate of future claims} + A(\tau) + \textit{risk equalisation allowance} + \textit{risk margin} \quad (10)$$

Supposing other expenses such as commission are considered, then an equivalence of equation (9) can be formulated as follows

$$\textit{claims} + \textit{commission} + \textit{expenses} + \textit{profit} = \textit{investment} + \textit{gross premium} \quad (11)$$

Under a private medical insurance program, the, gross premium can adjusted

If $PV(.)$ is the present value function, then from the foregoing and in view of equation (10) the pricing of contribution rates as equation of value is formulated as follows:

$$PV(\textit{claims}) + \mathrm{PV}(\textit{commission}) + PV(\exp\textit{enses}) + PV(\textit{profit}) = PV(\textit{investment}) + PV(\textit{gross premium}) \quad (12)$$

As a rule, the reserve is usually ignored in the formula technique and consequently, other legal expenses such as tax is taken into consideration by varying the discount $v^s = \dfrac{1}{(1+i)^s}; i = \textit{interest rate}$ the function applied in computing the present value. The insurance profit margin is usually obtained as a percentage of annual contribution so that the equation above can be solved to obtain the annual premium called zero-premium based on the estimated present value of claims, commission, expenditure and investment. Management expenses comprise all expenditure and investment income as a subclass of the fund's assets that are connected directly to the health insurance contract and its aggregated surpluses or capital. The actuarial analyst takes responsibility for the correctness of the data applied for the set assumptions used in the valuation and pricing model. The core objectives of health insurance while estimating contribution rates and determining forward forecasts resembles that of insurance liability valuations but have a distinct dimension such as contribution rate reviews, appraisal of future profitability margin, solvency adequacy and capital sustainability, recognition of pricing and projection components. The pricing components bear semblance with those of the future claim liability as proved by the number of funds that use the projection of the future claim cost as input to the future claim liability.

National health insurance is characterized under the following assumptions:(1) Compulsory scheme of participation for all enrollees of a specified class regulated at law, (2) contributions are not risk-associated payment on behalf of the enrollees. Salary-related contributions are computed and are shared between enrollees and employers. Usually, there is varying degree of modifications for uniformity of ratings, the proportion of enrollees to employer contributions, the existence of upper bound for contribution and the responsibilities of regulators in funding. Members of the family may or may not be granted cover on the account of contributions. However, under the multi-fund framework, the extent of pooling of fund is dependent on risk equalization dynamics across the scheme.

3. Material and Methods

3.1 Formulation of the Model

A central domain of actuarial function is associated with the provision of contracts of health insurance characterized by the advance payment of contributions in exchange for payments which are contingent on pre-defined but uncertain future events. This section describes the actuarial procedures that define the framework required to model this contribution. The models are formulated based on both legal framework (The National health insurance scheme) and actuarial assumptions. The main assumptions of the data analysis and the models are:

(i) The ratio of contributions $a:b:c=65:30:5$ usually negotiated by labour union
(ii) The number of dependents that is subject to a maximum of 4 children
(iii) The contributing population only consists of enrollees in paid employment, and
(iv) The age of the enrollees will not be considered in computing the contribution.

The parameters used in estimating the contribution rate for employees, employer and government are defined below.

$S(\tau)$ is employee's salary at time τ

ρ is government's contribution

ζ is employer's contribution

ψ is employee's contribution

ART is the actuarial rate

a is the government's ratio

b is the employer's ratio

c the employee's ratio

Σ is the total contribution

π is the dependent's factor

N is the number of dependents

Based on the parameters defined above, the models are constructed as follows

$$Model\ 1: \rho = ART \times S(\tau) \times \pi \times a \tag{13}$$

$$Model\ 2: \quad \psi = ART \times S(\tau) \times N \times c \tag{14}$$

$$Model\ 3: \ \zeta = ART \times S(\tau) \times \pi \times b \tag{15}$$

$$\Sigma = \psi + \zeta + \rho = ART \times S(\tau) \times (Nc + \pi b + \pi a) \tag{16}$$

The contributions in equations (13), (14) and (15) would only be collected if the enrollee is still surviving in paid employment with probability ${}_sP_a$, which is the probability that an enrollee aged a survives to age $a+s$. Consequently, the present value function of future health contributions for the enrollees at time s is defined as $PV(s) = \left(\frac{\Phi}{1+i}\right)\sum_{s=0}^{R-1}({}_sP_a)S(a+s)$, where Φ is the actuarial fair contribution, $S(a+s)$ is the annual salary at age $s+a$, $\left(\frac{1}{1+i}\right)$ is the discount factor, a is initial age when the enrollee enters

the program, ${}_sP_a = \frac{l_{s+a}}{l_a}$ and l_a is the number of survivors to age a. The total employee's contribution is projected using the number of dependents gotten from family statistics such as the percentage of married individuals, average number of children and insured employee's contribution ratio. The aggregate contribution would then be a function of average insurable salary, the number of insured employees together with dependents and the ratio of contribution. The age profile across the enrollee's population is not used because in general, payments of capitation are not tabulated according to individual age.

The contributions would be computed on monthly basis under the assumptions below: It is expected that the enrollees pay monthly contribution fully at the period of registration but exempted from the month of withdrawal. Where there is no withdrawal and subsequent transfer out to another employment at the month of registration, then the full monthly contribution of the enrollee is computed by the enrolling initial employer. However, irrespective of whether enrollment or withdrawal events take place simultaneously in the same month excepting cases where the enrollee and his insurance is transferred out on the final date of the month, the contributions would not necessarily be counted by the original insurance registration employer during the month when the transfer takes effect.

4. Data Presentation and Analysis

The health contribution in the formal sector assumes the form of pay-roll deduction based on the parameters of pay-roll levels and contribution rates. The national health insurance contribution for the categories treated in this paper is computed based on monthly salaries reported to the national health administration. For the purpose of the contribution rate estimation, the computation of the appropriate estimate requires the data to be considered over three categories that exhibit similar contribution rating characteristics. We collected current payroll data from a certain going concern registered with the Nigerian health insurance scheme. In computing the contribution rates for each employee, we consider the number of dependents in each family while for the government and employer contribution rate, the standard average dependent factor is applied. Since neither the employee, employer nor government could bear the full burden of health care cost and to demonstrate the computation procedures in particular, we assume government: employer: enrollees contribution ratio $a:b:c = 65:30:5$ to fall in line with our objective intended to build a sustained health insurance delivery which may encourage good health outcomes through care which is responsive to the enrollees. We have assumed enrollment at adequate levels under an equilibrium risk pool and a stable regulatory framework that encourages a healthy competitive environment. Furthermore, it is expected that health insurers will participate sufficiently so that plan offerings can enable enrollees' choice of high quality health care. However, the ratio can always be varied according to the intended objective. The human resources manager of the firm was responsible for the appropriateness of the data collected and used to determine the assumptions in the model. In order to validate the salary data, the reasonable step was taken to confirm from each enrollee the overall correctness of the staff data. We were given access to collect information on the number of children of each staff. The suggested ratio was considered in our actuarial analysis and computations. The parameters and staff salaries were fed into the system and contributions were computed. The formal sector health insurance program is a health security system where the health care of the enrollees is taken care of out of the funds generated by pooling the contributions of employees and employers.

The following parameters form the basis of computing the contribution rate. (i) the current salary on which contributions are computed based on payroll (ii) the insurance premium rate (iii) the contribution ratio (iv) the average number of children subject to a maximum of four children and (v) the average number of dependents. These data were then fed into the equations (13), (14) and (15) appropriately.

Table 1: ***Enrollee's contribution***

IDENTITY NUMBER	ANNUAL SALARY	MONTHLY SALARY	INSURANCE RATE	NUMBER OF CHILDREN	ENROLLEE'S CONTRIBUTION	TOTAL
1	753560.00	62796.67	2945.16	3	147.26	589.03
2	516032.00	43002.67	2016.83	2	100.84	302.52
3	556084.00	46340.33	2173.36	1	108.67	217.34
4	822388.00	68532.33	3214.17	4	160.71	803.54
5	2197168.00	183097.33	8587.26	3	429.36	1717.45
6	5296300.00	441358.33	20699.71	4	1034.99	5174.93
7	8731504.00	727625.33	34125.63	3	1706.28	6825.13
8	2825860.00	235488.33	11044.40	4	552.22	2761.10
9	4780032.00	398336.00	18681.96	3	934.10	3736.39
10	5440008.00	453334.00	21261.36	3	1063.07	4252.27
11	2383504.00	198625.33	9315.53	2	465.78	1397.33
12	4874032.00	406169.33	19049.34	2	952.47	2857.40
13	4810136.00	400844.67	18799.61	4	939.98	4699.90
14	879504.00	73292.00	3437.39	2	171.87	515.61
15	1689544.00	140795.33	6603.30	4	330.17	1650.83
16	798948.00	66579.00	3122.56	4	156.13	780.64
17	8798616.00	733218.00	34387.92	3	1719.40	6877.58
18	7650616.00	637551.33	29901.16	4	1495.06	7475.29
19	5425828.00	452152.33	21205.94	3	1060.30	4241.19
20	3760392.00	313366.00	14696.87	4	734.84	3674.22
21	2134504.00	177875.33	8342.35	4	417.12	2085.59
22	3456060.00	288005.00	13507.43	3	675.37	2701.49
23	5450268.00	454189.00	21301.46	4	1065.07	5325.37
24	5494184.00	457848.67	21473.10	4	1073.66	5368.28
25	4302700.00	358558.33	16816.39	3	840.82	3363.28
26	5678700.00	473225.00	22194.25	4	1109.71	5548.56
27	6289380.00	524115.00	24580.99	1	1229.05	2458.10
28	4128392.00	344032.67	16135.13	2	806.76	2420.27
29	3508044.00	292337.00	13710.61	3	685.53	2742.12
30	5835084.00	486257.00	22805.45	4	1140.27	5701.36
TOTAL	**119267372.00**	**9938947.67**	**466136.65**		**23306.83**	**98264.10**

Table 2: ***Employer's contribution***

IDENTITY NUMBER	ANNUAL SALARY	MONTHLY SALARY	INSURANCE RATE	DEPENDENT'S CONTRIBUTION	EMPLOYER'S CONTRIBUTION
1	753560.00	62796.67	2945.16	4653.36	1396.01
2	516032.00	43002.67	2016.83	3186.58	955.98
3	556084.00	46340.33	2173.36	3433.91	1030.17
4	822388.00	68532.33	3214.17	5078.38	1523.51
5	2197168.00	183097.33	8587.26	13567.88	4070.36
6	5296300.00	441358.33	20699.71	32705.54	9811.66
7	8731504.00	727625.33	34125.63	53918.49	16175.55
8	2825860.00	235488.33	11044.40	17450.16	5235.05
9	4780032.00	398336.00	18681.96	29517.49	8855.25

10	5440008.00	453334.00	21261.36	33592.96	10077.89
11	2383504.00	198625.33	9315.53	14718.53	4415.56
12	4874032.00	406169.33	19049.34	30097.96	9029.39
13	4810136.00	400844.67	18799.61	29703.39	8911.02
14	879504.00	73292.00	3437.39	5431.08	1629.33
15	1689544.00	140795.33	6603.30	10433.22	3129.96
16	798948.00	66579.00	3122.56	4933.64	1480.09
17	8798616.00	733218.00	34387.92	54332.92	16299.88
18	7650616.00	637551.33	29901.16	47243.83	14173.15
19	5425828.00	452152.33	21205.94	33505.39	10051.62
20	3760392.00	313366.00	14696.87	23221.05	6966.31
21	2134504.00	177875.33	8342.35	13180.92	3954.28
22	3456060.00	288005.00	13507.43	21341.75	6402.52
23	5450268.00	454189.00	21301.46	33656.31	10096.89
24	5494184.00	457848.67	21473.10	33927.50	10178.25
25	4302700.00	358558.33	16816.39	26569.89	7970.97
26	5678700.00	473225.00	22194.25	35066.92	10520.08
27	6289380.00	524115.00	24580.99	38837.97	11651.39
28	4128392.00	344032.67	16135.13	25493.51	7648.05
29	3508044.00	292337.00	13710.61	21662.76	6498.83
30	5835084.00	486257.00	22805.45	36032.62	10809.78
TOTAL	**119267372.00**	**9938947.67**	**466136.65**	**736495.90**	**220948.77**

Table Go*vernment's contribution*

IDENTITY NUMBER	**ANNUAL SALARY**	**MONTHLY SALARY**	**INSURANCE RATE**	**CONTRIBUTION RATE**	**GOVERNMENT'S CONTRIBUTION**
1	753560.00	62796.67	2945.16	4653.36	3024.68
2	516032.00	43002.67	2016.83	3186.58	2071.28
3	556084.00	46340.33	2173.36	3433.91	2232.04
4	822388.00	68532.33	3214.17	5078.38	3300.95
5	2197168.00	183097.33	8587.26	13567.88	8819.12
6	5296300.00	441358.33	20699.71	32705.54	21258.60
7	8731504.00	727625.33	34125.63	53918.49	35047.02
8	2825860.00	235488.33	11044.40	17450.16	11342.60
9	4780032.00	398336.00	18681.96	29517.49	19186.37
10	5440008.00	453334.00	21261.36	33592.96	21835.42
11	2383504.00	198625.33	9315.53	14718.53	9567.05
12	4874032.00	406169.33	19049.34	30097.96	19563.67
13	4810136.00	400844.67	18799.61	29703.39	19307.20
14	879504.00	73292.00	3437.39	5431.08	3530.20
15	1689544.00	140795.33	6603.30	10433.22	6781.59
16	798948.00	66579.00	3122.56	4933.64	3206.86
17	8798616.00	733218.00	34387.92	54332.92	35316.40
18	7650616.00	637551.33	29901.16	47243.83	30708.49
19	5425828.00	452152.33	21205.94	33505.39	21778.50
20	3760392.00	313366.00	14696.87	23221.05	15093.68

21	2134504.00	177875.33	8342.35	13180.92	8567.60
22	3456060.00	288005.00	13507.43	21341.75	13872.14
23	5450268.00	454189.00	21301.46	33656.31	21876.60
24	5494184.00	457848.67	21473.10	33927.50	22052.88
25	4302700.00	358558.33	16816.39	26569.89	17270.43
26	5678700.00	473225.00	22194.25	35066.92	22793.50
27	6289380.00	524115.00	24580.99	38837.97	25244.68
28	4128392.00	344032.67	16135.13	25493.51	16570.78
29	3508044.00	292337.00	13710.61	21662.76	14080.79
30	5835084.00	486257.00	22805.45	36032.62	23421.20
TOTAL	**119267372.00**	**9938947.67**	**466136.65**	**736495.90**	**478722.33**

Table 4: ***Comparative contributions***

MONTHLY SALARY	EMPLOYEE TOTAL CONTRIBUTION	EMPLOYER TOTAL CONTRIBUTION	GOVERNMENT TOTAL CONTRIBUTION
753560.00	589.03	1396.01	3024.68
516032.00	302.52	955.98	2071.28
556084.00	217.34	1030.17	2232.04
822388.00	803.54	1523.51	3300.95
2197168.00	1717.45	4070.36	8819.12
5296300.00	5174.93	9811.66	21258.60
8731504.00	6825.13	16175.55	35047.02
2825860.00	2761.10	5235.05	11342.60
4780032.00	3736.39	8855.25	19186.37
5440008.00	4252.27	10077.89	21835.42
2383504.00	1397.33	4415.56	9567.05
4874032.00	2857.40	9029.39	19563.67
4810136.00	4699.90	8911.02	19307.20
879504.00	515.61	1629.33	3530.20
1689544.00	1650.83	3129.96	6781.59
798948.00	780.64	1480.09	3206.86
8798616.00	6877.58	16299.88	35316.40
7650616.00	7475.29	14173.15	30708.49
5425828.00	4241.19	10051.62	21778.50
3760392.00	3674.22	6966.31	15093.68
2134504.00	2085.59	3954.28	8567.60
3456060.00	2701.49	6402.52	13872.14
5450268.00	5325.37	10096.89	21876.60
5494184.00	5368.28	10178.25	22052.88
4302700.00	3363.28	7970.97	17270.43
5678700.00	5548.56	10520.08	22793.50
6289380.00	2458.10	11651.39	25244.68
4128392.00	2420.27	7648.05	16570.78
3508044.00	2742.12	6498.83	14080.79
5835084.00	5701.36	10809.78	23421.20
67581772.00	**98264.10**	**220948.77**	**478722.33**

Table 5: ***Direct application of official percentage contribution on salary***

IDENTITY NUMBER	ANNUAL SALARY	MONTHLY SALARY	CIVIL SERVANT CONTRIBUTION	FEDERAL EMPLOYER CONTRIBUTION	TOTAL CONTRIBUTION
1	753560.00	62796.67	1098.94	2040.89	3139.83
2	516032.00	43002.67	752.55	1397.59	2150.13
3	556084.00	46340.33	810.96	1506.06	2317.02
4	822388.00	68532.33	1199.32	2227.30	3426.62
5	2197168.00	183097.33	3204.20	5950.66	9154.87
6	5296300.00	441358.33	7723.77	14344.15	22067.92
7	8731504.00	727625.33	12733.44	23647.82	36381.27
8	2825860.00	235488.33	4121.05	7653.37	11774.42
9	4780032.00	398336.00	6970.88	12945.92	19916.80
10	5440008.00	453334.00	7933.35	14733.36	22666.70
11	2383504.00	198625.33	3475.94	6455.32	9931.27
12	4874032.00	406169.33	7107.96	13200.50	20308.47
13	4810136.00	400844.67	7014.78	13027.45	20042.23
14	879504.00	73292.00	1282.61	2381.99	3664.60
15	1689544.00	140795.33	2463.92	4575.85	7039.77
16	798948.00	66579.00	1165.13	2163.82	3328.95
17	8798616.00	733218.00	12831.32	23829.59	36660.90
18	7650616.00	637551.33	11157.15	20720.42	31877.57
19	5425828.00	452152.33	7912.67	14694.95	22607.62
20	3760392.00	313366.00	5483.91	10184.40	15668.30
21	2134504.00	177875.33	3112.82	5780.95	8893.77
22	3456060.00	288005.00	5040.09	9360.16	14400.25
23	5450268.00	454189.00	7948.31	14761.14	22709.45
24	5494184.00	457848.67	8012.35	14880.08	22892.43
25	4302700.00	358558.33	6274.77	11653.15	17927.92
26	5678700.00	473225.00	8281.44	15379.81	23661.25
27	6289380.00	524115.00	9172.01	17033.74	26205.75
28	4128392.00	344032.67	6020.57	11181.06	17201.63
29	3508044.00	292337.00	5115.90	9500.95	14616.85
30	5835084.00	486257.00	8509.50	15803.35	24312.85
TOTAL	**119267372.00**	**9938947.67**	**173931.58**	**323015.80**	**496947.38**

5 Discussion of Results

The salary-related contributions in table 4 represent the total contributions payable by employees, employers and government in the respective sum of ₦98264.10, ₦220948.77 and ₦478722.33 as confirmed in table 1, table 2 and table 3. These contributions are based on the assumptions listed in section 3. They define the offset needed for the enrollees to qualify for the benefits. Table 4 is a summary of employee's, employer's and government's contributions based on the direct application of the models in equation (13), (14) and (15). From the result obtained in table 4, the enrollees' contribution subject to a maximum of four children nearly equates to 0.15% of the total monthly salary while the employer's contribution stands about 0.33% of the total monthly salary to be used as the social health contributions. However, the government's contribution represents about 0.71% of the total monthly salary associated with national health expenditure and which is almost twice that of the employees'. The total contribution

based on our models in equation (13), (14) and (15) that would be remitted to the national health insurance fund is ₦797,935.20 which is about 1.18% of the total monthly salary. This amount represents the sum of ₦98,264.10 ₦220,948.77 and ₦478,722.33 in table 4. In order to define the flow of contributions that the employers, government and employees would make, the contribution rate should be applied to the flow of insured salaries that grows annually through real growth rate. This contribution would only be collected if the enrollee is still alive in the work force. Under the regulatory framework set out in the national health insurance scheme, every enrollee pays 1.75% of his monthly basic salary. It is amazing that while employee's total contribution under our model in equation (14) is ₦98,264.10, the employee's contribution in table 5 under the official engagement of 1.75% times the monthly salary stands at ₦173,931.58. The difference of ₦75,667.48 in employee's contribution between the official rate devoid of actuarial basis and the model result based on equation (14), therefore represents a gap in health care contributory program. This is the amount by which the enrollees have been unfairly overcharged. The coverage contribution rate has been driven upwards as a result of the regulatory frame-work mandating it in the formal sector. Since the health contributions will not progressively accumulate into an asset as in retirement benefits, the amount representing overcharge will lead to stiff opposition hence the system cannot promote social unity. Enrollees who contribute large amount into health funds and under-utilize health benefits will loose substantially.

Policy regulators should address this gap in contribution rating and by extension, service quality otherwise the current inequalities could be aggravated when contributory funds move to the service providers. Since the volume of payroll functionally determines the contribution density, high contribution as officially defined by the government may reasonably favour the principle of adequacy on the part of health regulators.

In table 4, the cost to an employer when an employee enrols in the scheme exceeds more than twice the cost of the employee's enrollment. In other words, the insurance cost burden on employers depends critically on the ratio of participating employees who enrol in the health insurance scheme. The cost of obtaining health insurance to employees is dependent not only on contributions but on the proportions of employees who participate in the health insurance enrollment. The estimated contributions should be compared with income projections otherwise where revenues are not adequate, then health insurance cost must be eliminated by bringing in cost containment measures. The computations would then ascertain that contributions for the enrollees are cheap, adequate and feasible in the long run. The enrollees' contribution influences their disposable earnings and savings behaviour while the employer's contributions impact labour cost. These contributions are gathered to finance national health insurance schemes. The contributions are usually compulsory and not risk associated but function of insured salary income which has been gathered from the payroll. Employers and employees participate in a sharing contribution. This involves the formal labour market which equates to an increasing area of cover over formal sector enrollees and their dependents. In practice, enrollee's ratio could be infinitesimally small as one percent of the insured monthly salary. The contribution is a function of capacity to pay but access to health services are based on needs. Contributions could be gathered through lone national health insurance fund or vide more national health insurance funds that are usually independent of the government but subject to regulations.

Basically, the contribution is a function of the insurance ratings used in the computations. These contributions computed are actuarial estimates of the sum that would be needed to provide cover on: (i) the expected cost of the health benefits covered in the scheme (ii) the management costs of administering the scheme and (iii) profit margin. We note that the contribution ratio may be subjected to changes to suit the intended policy goal on four principles of equity, reasonableness, competitiveness and adequacy. The health insurance contribution would likely be possible if there exists a smooth agreement between enrollees' expectations and policy design decisions. The possibility of national health insurance based on the shared contributions above would be depending much on the existing operational capacity to run several distinct technical functions in particular actuarial analysis, enrollment management, collection of funds, claims administration. The health insurance system will usually be unstable because of operational challenges associated with contributions such as claims not being paid timely, providers dropping out, enrollees do not seem to know the depth of benefits and do not access services. While it is not a requirement that all operational functions be available, we suggest that health insurance administrative procedures need be considered when designing health insurance schemes.

The functional value of the employer's contribution is not a financial issue but rather a form of policy issue because employers usually take their contributions as an integral part of salary costs. The dichotomy between employer and employee contributions will be critical in the short term but in a fairly competitive labour market, employers consider the ultimate cost implications of hiring employees and take the cost of the health insurance scheme in part as being necessarily the same as salary costs. At the other side to the employee, it would look as if employers satisfy some of the cost of the health insurance scheme, but it means that employers pay smaller salaries than what they would have paid when there are no shared health insurance contributions. The policy value together with the benefit of employer contributions defines their core function in cost containment mechanisms. Actually, there is no proven evidence that employers enjoy any direct benefit from health insurance program other than healthy staff productivity and consequently, employers are to maintain contribution which is consistently low and constant.

The variation between employer and employee contribution may cause ambiguity when assessing contributions for the informal sector. As self-employed individuals do not have employer contribution, the problem arises as to whether they should pay both employee contribution and employer contribution or only employee contribution. The low salary earners constituting a reasonable percentage of the civil service are at risk under health uncertainty hence health insurance funding strategy could be structured to accommodate the low salary earners to have a hundred percent exemption from contributing to it. The current discussions on the estimation of contributions have not been in vain as the significance of this topic to the welfare of the civil service cannot be denied. The problem of unfair rating in contributions, one of the controversial issues in health insurance system has resulted in inequalities and distress among the enrollees who are worried about the consumption of their contributions linked to their low income. Currently from the result presented, there are indications that the contributions collected on behalf of enrollees seem too high and hence unfair. It may be interesting for the health regulators to make issues clear to the civil service which benefits would be efficiently covered by the social contributions and this would make it clear what the social contribution rate should really cover. Therefore, it is recommended that affordable contribution rating, phenomenal risk coverage and paying attention to preventive services should be the main priority of health insurance regulators.

The intervention in health services is carried out to attain the desired health output using the appropriate indicators. The essence of health indicators lies in dealing with operational challenges so that government can appraise and improve health care services through interventions.

Letting $\sum_{\zeta}$ be the sum of health contributions in year ζ payable at the end of the year and r be the contribution ratio. The Government normally uses health indicator H to guide health care policies. We define H, the health insurance indicator function as follows:

$$H_I = \begin{cases} 0 \quad For \text{ interruption } in\ employment \\ 1 \quad If\ otherwise \end{cases} \tag{17}$$

$$H_{I/\theta} = \begin{cases} 0 \quad For \text{ interruption } in\ employment \\ \theta \quad Slow down\ in\ employment \\ 1 \quad If\ otherwise \end{cases} \tag{18}$$

$$\frac{\sum_{\zeta+1}}{\sum_1} = \left(1 + r \times H_I + S(\zeta+1) - S(\zeta) \times H_{I/\theta}\right) \Rightarrow \tag{19}$$

$$\sum_{\zeta+1} = \sum_1 \left(1 + r \times H_I + \Delta S(\zeta) \times H_{I/\theta}\right) \tag{20}$$

then equations (13), (14) and (15) become

$$\rho_{\zeta+1} = \rho_1 \times \left(1 + a \times H_I + \Delta S(\zeta) \times H_{I/\theta}\right) \tag{21}$$

$$\psi_{\zeta+1} = \psi_1 \times \left(1 + c \times H_I + \Delta S(\zeta) \times H_{I/\theta}\right) \tag{22}$$

$$\zeta_{\zeta+1} = \zeta_1 \times \left(1 + b \times H_I + \Delta S(\zeta) \times H_{I/\theta}\right) \tag{23}$$

$\Delta S(\zeta)$ is further increase in payroll salary in year ζ associated with work experience.

6. Conclusion

The contributions are actuarially computed rate per individual enrollee of an occupation-based group and payable in cash in cash in advance of time. While there are defined contribution based papers, there has not been consistently growing embodiment of research demonstrating the application of the above technique to model health insurance system to inform policy on contributions in a range of settings. The current direction in health service delivery which includes rising health care costs, issues associated with weak health service delivery and the need for more enrollee participation, necessitates employers to consider shifting from traditional pay as you go health insurance premium to defined contribution scheme and evolve actuarial based contributory rating. The combination of cost management, actuarial computational procedures and employer participation differentiate contribution-based schemes from pay as you go system of funding health plans and at the same time makes contribution-based health plans most preferred and convenient for employers in general. Contribution-based schemes are being defined along a trajectory of the health insurance continuum with diverse level of employer and employee functions. One side of the continuum includes the pay as you go model with functional management by the employer while at the other side of the continuum, the enrollee contributes fund to jointly manage his own health benefits thus eliminating stabilization costs and permitting more enrollees responsibility.

As seen in our computation, the contribution depends on the insurance ratings, standard average dependent factor and employee's number of dependents subject to a maximum of four children used in the computation. Sharing costs of health care with employees is a calculated approach to manage the costs. The health insurance contributions only define an integral proportion of the individual enrollee's costs incurred under the benefits scheme for health services. Actuarial work in Nigeria in the area of health insurance program is non-existing and that is the reason why previously published research work if any are deficient in real actuarial evidence when compared to what obtains in advance economies such as Italy. The form of data profile generated is limited and available actuaries seem incompetent to formulate actuarial models for the Nigerian environment as a function of the available data.

If the regulator's expectation of a particular level of enrollees' contribution is higher than that of the general population, then there is a chance of default in contribution collection. To address this form of noncompliance, policy regulations could appraise the enrollee's expectations and commitment to pay for health insurance vides quality data collection technique otherwise the ratio could be renegotiated. Traditional norms can essentially impact the ultimate success of a health insurance program especially where individual enrollee ignores the risk of sickness while others are critically risk-averse. Enrollees' knowledge changes significantly as to whether social-economic equity is a core national objective and the degree to which care of the sick individual should be the function of the larger population. If policy regulations do not address gaps in service quality and contribution rating, then they inadvertently risk allowing current inequalities to be aggravated when contributory funds move to the providers on ground. Providers may be unwilling to take part where the insurance payments are deemed ridiculously small. Consequently, providers could start refusing to provide services to enrollees in the insurance scheme because the reimbursement rates are perceived as smaller than the actual costs since providers will be at loss servicing enrollees. National health insurance scheme source and distribute financial resources within the frame-work of health system to satisfy the immediate health challenges of the enrollees with a view to expected future needs. Individual enrollees may access health care through third-party financing arrangements such as national health service of social insurance or through direct payment for services and consequently the theory of health insurance financing schemes serves as key application and extension of the concept of social protection schemes. Research in this emerging area of insurance is at its nascent level, more work is required to obtain models which could generalize distinct areas of health insurance especially in evaluating aggregate contribution analyses based on stochastic technique.

References

[1] American Academy of Actuaries(AAA). (**2008**). Participation requirements in group health plans https://www.actuary.org/sites/default/files/pdf/health/coverage_ib_08.pdf

[2] Barber, S.L., Lorenzoni, L., & Ong, P.(**2019**). Price setting and price regulation in health care: Lessons for advancing universal health coverage. World health organization, organization for economic cooperation and development. License: CC BY-NC-SA 3.0 IGO

[3] Burtless, G., & Milusheva, S. (**2013**). Effects of Employer-Sponsored Health Insurance Costs on Social Security Taxable Wages, *Social Security Bulletin*, **73**(1). https://www.ssa.gov/policy/docs/ssb/v73n1/v73n1p83.html Social Security

[3] Cichon, M., Newbrander, W., Yamabana, H., Weber, A., Normand, C., Dror, D., & Preker, A. (**1999**). Modelling in health care finance: A compendium of quantitative technique for health care financing. A joint technical publication of the International Labour Office(ILO) and the International Social Security Association (ISSA).

[4] Faden, L., Vialle-Valentin, C., Ross-Degnan, D., & Wagner, A. (**2011**). WHO /HAI project on medicine prices and availability. Review series on pharmaceutical pricing policies and interventions working paper 2: The role of health insurance in the cost-effective use of medicines.

[5] Intan, S.S., Noor, H.I, Azreena, E., Arinah, W.D.S., Musheer, J., & Muhamad, H .J. (**2016**). Health care provision and equity. *International Journal of Public Health and Clinical Sciences*, **3**(4): 1-14

[6] Mclntyre, D., Garshong, B., Mtei G., Meheus F., Thiede M., Akazili J., Alli M., Aikins M., Mulligan J.A., & Goudge J. (**2008**). Beyond fragmentation and towards universal coverage: insight from Ghana, South Africa and the united republic of Tanzania, *Bulletin of the world health organization,* **86**:871-876.

[7] Newsom, M. & Fernandez, B. **(2011)**. Private health insurance premiums and rate reviews. Washington, DC: Congressional Research service. http://digitalcommons.ilr.cornell.edu/key_workplace/788

[8] Normand, C., Weber, A., Carrin, G., Doetinchem, O., Mathuer, I., Scheil-Adlung, X., & Schmidt, J.O. (**2009**). Social health Insurance: A guide for planning, joint initiative of ADB, ILO, WHO, GTZ, VAS Verlag fur Akademische Schriften, (2nd ed.)

[9] Odeyemi, A.O., & Nixon, J. (**2013**). Assessing equity in health care through the national health insurance schemes of Nigeria and Ghana: a review based comparative analysis. *International Journal for Equity in health*, **12**(9): 1-18

[10] Ramjee, S., Vieyra, T., Abraham, M., Kaplan, J., & Taylor R. (**2014**). National health insurance and South Africa's Private Sector, South. *African Health Review,* **1:** 93–105

[11] The National Health Insurance Scheme[Nigeria]. http://www.nhis.gov.ng

[12] Tao, C. (**n.d**). Pricing private health insurance products in China https://www.actuaries.org/IAAHS/Colloquia/Dresden/Tao%20paper.pdf

[13] Wagstaff, A. (**2010**). Social health insurance re-examined. *Health economics*, **19**: 503-517

[14] Wagstaff, A., & Van-Doorslaer, E. (**2000**). Equity in health care finance and delivery. A handbook of Health Economics. Edited by Culyer A.J, Newhouse JP. The Netherlands: Elsevier.

□□