




Public Health Insurance: An Approach to Mitigate the Burden of Diabetes in Low Resource Settings


Jideuma I. Egwim, PhD

Walden University, Minneapolis, Minnesota, United States

 <https://orcid.org/0009-0001-4859-7163>


Namgyal Kyulo, DrPH

Walden University, Minneapolis, Minnesota, United States

 <https://orcid.org/0000-0002-9416-7447>

Hadi Danawi, PhD

Walden University, Minneapolis, Minnesota, United States

 <https://orcid.org/0000-0002-7288-4189>

Aaron B. Mendelsohn, PhD

Walden University, Minneapolis, Minnesota, United States

Contact: jidegwim@yahoo.com

Abstract

Background: Diabetes mellitus is a significant public health concern globally as well as in Owerri, Nigeria. The deleterious effects of diabetes have been linked to poor glycemic control. According to the International Diabetes Federation, poor glycemic control is reflected in glycosylated hemoglobin levels greater than 7.0%, which are associated with substantial morbidity and mortality. Studies have shown a dramatic rise in diabetic complications in Nigeria, particularly in Owerri. However, evidence is lacking on specific risk factors associated with poor glycemic control among diabetes mellitus patients in Owerri. There is a gap in the literature regarding the association between health insurance and glycemic control in diabetic patients in Owerri. With health insurance assuming a significant position in healthcare service delivery in Nigeria, addressing this gap is valuable.

Methods: We performed a cross-sectional study of health insurance as a determinant of glycemic control among 160 type 2 diabetic patients attending the family medicine clinic at the Federal University Teaching Hospital, formerly the Federal Medical Center, Owerri. Participants were measured as not insured, insured-private, and insured-public/National Health Insurance Scheme. The dependent variable was glycemic control measured using glycosylated hemoglobin. We used ecosocial theory as the theoretical framework of this research. SPSS was used for data analysis; multiple logistic regression was applied to assess the association between insurance status and glycemic control in the participants.

Results: In the patients without health insurance coverage, the prevalence of poor glycemic control was 93.8% whereas in those with health insurance coverage, the prevalence was 60.0%. Logistic regression analysis showed that lack of access to health insurance was a determinant of glycemic control, with uninsured

subjects at 28 times and 6 times increased risk of poor glycemic control compared with insured-private and insured-public subjects, respectively.

Conclusion: We have shown in our study that insured enrollees have an increased likelihood of good glycemic control relative to uninsured subjects. This finding has the potential to promote positive social change through optimization of the National Health Insurance Scheme. Enabling regulations and designing policies to explicitly cover diabetes preventive and control services in the scheme could lead to improved glycemic control, and, thus, reduce the burden of the disease.

Keywords: *diabetes mellitus, health insurance, glycemic control*

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Introduction

Health insurance coverage in Nigeria is broadly of two types, the public and private schemes. The public type (National Health Insurance Scheme [NHIS]) is run by the government. NHIS was launched in 1997 with the enabling act passed in May 1999. Though the law establishing the NHIS made provision for all residents of Nigeria, only a few are enrolled in the scheme due to poor implementation. These are primarily employees and students in a few federal government institutions. Therefore, staff in the employment of most state and local government areas or small and medium enterprises as well as the retired, self-employed persons, most students, and the unemployed are left without any coverage. The private scheme is run by health management organizations (HMOs) and mostly includes employees of the organized private sector and international nongovernmental organizations. Due to its poor performance, the act was repealed and replaced with an act for the establishment of the National Health Insurance Agency (NHIA) in May 2022. The fundamental difference between the NHIS and NHIA is that the latter affirms compulsory health insurance for every Nigerian and all legal residents of Nigeria, as an approach to achieve universal health coverage. Nigeria's NHIA is analogous to Medicaid, which is the U.S. public health insurance program.

Access to health insurance coverage results in enhanced utilization of healthcare services, which may impact glycosylated hemoglobin (HbA1c) levels in diabetic subjects (Doucette et al., 2016). HbA1c is the marker for glycemic control in diabetic subjects, and the injurious actions of diabetes mellitus (DM) result from poor glycemic control with associated increased risk of complications, reduced quality of life, and worsening morbidity and mortality (Mahmood et al., 2016). DM is a chronic metabolic disorder characterized by hyperglycemia from defective insulin secretion and/or action. It is a major public health concern globally with a prevalence that has quadrupled in the last 30 years, and it is a significant contributor to morbidity and mortality, causing approximately 10% of all deaths annually worldwide (Zheng et al., 2018).

Owerri, in southeast Nigeria, is essentially a civil and public service town with a huge population of federal government staff with public health insurance coverage. Engagement in the federal government service guarantees the privilege of enrollment in the NHIA, which most staff activate upon employment. As observed in other regions globally, the burden of DM has been on the rise in Owerri with Nwaokoro et al. reporting a prevalence of 11% in 2021. Despite the high prevalence of DM in Owerri, and with the disease constituting a substantial percentage of inpatient care in tertiary centers in the town (Ezeama & Enwereji, 2019), no studies have been conducted on the effect of health insurance on glycemic index.

In Nigeria, progressive improvement in public health insurance scheme enrollment, service utilization, and overall enrollee satisfaction have been observed (Michael et al., 2020). While unpublished data have shown a high use of healthcare services by diabetic patients on health insurance coverage in Owerri, the level of poor glycemic control remains high. More than 90% of the diabetic patients in Owerri have been reported to have poor glycemic control, which is among the highest globally (Anoshirike et al., 2019). There are reports of frequent delay and denial of payments to healthcare providers (HCPs), such that HCPs may resort to unethical practices, such as the use of poor-quality medications and denial of adequate care to diabetic patients on health insurance coverage. Such a situation may retard or reverse the expected gains of health insurance coverage toward improved diabetes care in Owerri and Nigeria as a whole (Campbell, 2018; Chukwu & Ezenduka, 2020). Furthermore, a significant differential exists in premium rates, extent of coverage, and valuation of fee-for-service payments to HCPs by HMOs for enrollees under the public and private health insurance schemes. This may result in health inequity due to differential quality in service offered to diabetic patients under the different health insurance packages, with attendant differences in glycemic control between enrollees under the public and private health insurance programs.

Our research is unique because, among the studies on predictors of glycemic control among adult diabetic subjects in Nigeria, none had assessed the effect of health insurance status (Anioke et al., 2019; David et al., 2019; Onodugo et al., 2019; Ufuoma et al., 2016). Health insurance is at the evolutionary stage in Nigeria; less than 22% of Nigerian citizens have some form of coverage (NOIPolls, 2019); of the few who have coverage, the majority belong to the public NHIS. Health insurance coverage is a tool to advance universal health coverage and will be a major determinant of health in Nigeria in the near future. With this in mind, we set out to determine the prevalence of poor glycemic control among type 2 diabetic patients in Owerri, southeast Nigeria, measured using HbA1c, and to investigate the association between health insurance and glycemic control in the subjects.

Theoretical Framework

Current research on diabetes has aimed at drawing attention to the associations between socioeconomic factors and DM control; thus, the theoretical underpinning for our study is the ecosocial theory. Ecosocial theory is a multilevel theory of disease occurrence that explains how social and biological reasoning are integrated with an ecological perspective to address population levels of disease (Anderson, 2020). Ecosocial theory provides the framework for the explanation of the many factors that influence glycemic control in diabetic subjects. Factors such as age and gender represent factors at the biological level that may influence glycemic control in diabetic subjects (Anioke et al., 2019), whereas health literacy, socioeconomic status, alcohol, tobacco smoking, and access to health insurance are social factors that may be considered to affect glycemic control in DM (Asmelash et al., 2019; Dedefo et al., 2020; Onodugo et al., 2019). Ecosocial theory helps researchers conceptualize a much broader array of social determinants with the key function of identifying specific and strategic opportunities for intervention to improve population health. The theoretical framework for our research is focused on assessing the association between the variables to drive the conception that health insurance status may influence glycemic control in diabetic subjects. According to Homan's theory of interaction, as reported by Creswell and Creswell (2018), the interaction between variables is such that one would expect the independent variable(s) to influence the dependent variable(s). Second, the independent variable, health insurance status, being a social determinant of health, interacts with environmental and biological factors to determine the dependent variable, glycemic control in diabetic patients.

Purpose of Study

We justified our study with the premise that the research outcomes will reveal any benefits to improved

glycemic control in diabetic patients derivable from access to health insurance. Thus, we can define approaches to drive optimal utilization of health insurance in the care of patients living with DM. The overall goal is to achieve improved care for Nigerians and other residents of the country.

Subjects and Methods

Our quantitative cross-sectional study was conducted among adult type 2 diabetic patients aged 18 years and older, attending the Federal University Teaching Hospital (FUTH), Owerri, for at least 6 months, and who consented to participate in the study. Exclusion criteria were patients with acute illness or critical illness that would have impaired their ability to participate in the study and patients with major psychiatric illness or impaired cognitive function. Ethical approvals were obtained from the health research and ethical committee of the FUTH, Owerri, and the Institutional Review Board at Walden University. The study design and conduct were in accordance with relevant ethical requirements following national and international guidelines relating to the conduct of noninterventional biomedical studies in human subjects, especially concerning patients' privacy, controlled access to data, and prohibition of data sharing (IRB, 2019; Tucker et al., 2016).

We introduced the study to the patients at the diabetes clinic while they were seated during health talk, which was traditionally done by the clinic staff before the clinic started each day. The Participants' Information Sheet was distributed to each patient. It introduced the researchers, the study title, and the reason for the study. A section explained the inclusion criteria, study procedure, and approaches to ensure the confidentiality of participants' data. Patients were informed of the discomfort, risks, and benefits of the study. The patients were told that participation was entirely voluntary, and they could decide not to participate or withdraw from the study at any time. Patients who volunteered to participate proceeded to the counseling room where a member of the research team guided them to complete the informed consent process by signing individual consent forms prior to data collection. At the end of data collection, participants were debriefed and informed to keep in contact with the diabetes clinic to be informed of the results of the study at publication. The contact details of the researcher were included in the Participants' Information Sheet should there be any questions or need for clarification/further counseling. Information obtained from each participant was handled with utmost confidentiality, and electronic data files were password protected.

The research question (RQ) and hypotheses were as follows:

RQ: Is there an association between health insurance status (not insured, insured-private, insured-public) and glycemic control among type 2 diabetic patients?

Ho: There is no association between health insurance status (not insured, insured-private, insured-public) and glycemic control among type 2 diabetic patients.

H1: There is an association between health insurance status: (not insured, insured-private, insured-public) and glycemic control among type 2 diabetic patients.

The study population comprised previously diagnosed diabetic patients attending the diabetes clinic on follow-up for at least 6 months. On average, the clinic attended to approximately 15 previously diagnosed diabetic patients each clinic day on follow-up, which is approximately 75 patients per week and 300 per month. An appropriate sample was calculated and recruited from the study population based on subjects who satisfied the inclusion criteria. Using G*Power under multiple logistic regression, input parameters were two-tailed test; level of significance = 5%; power of 80%; and probability of poor glycemic control in uninsured = 83.3%, as reported by Anioke et al. (2019) in a city proximal to Owerri in southeast Nigeria. R² was the amount of variability in the predictor (health insurance status) accounted for by the covariates. The presumption is the occurrence of a significant level of multivariable relationship among the covariates;

therefore, moderate association was assumed = 0.25; distribution is binomial. It was expected that the number of insured and uninsured subjects would be equal, thus, $X_{\text{parm}} = 0.5$. The adjusted OR calculated was 3.3, and the calculated sample size was 159. Therefore, a sample size of 160, split into 80 participants for insured and uninsured subjects, was used for our study. Our study was conducted from November 2021 to February 2022. Systematic random sampling technique was used to recruit participants who met the selection criteria. Health insurance status was measured in three categories: (1) uninsured, referring to participants who had no access to any form of health insurance coverage; (2) insured public, referring to participants enrolled under the NHIS; and (3) insured private, referring to participants under the private scheme. The outcome, glycemic control, was measured as a dichotomous variable, controlled or uncontrolled.

Data Collection

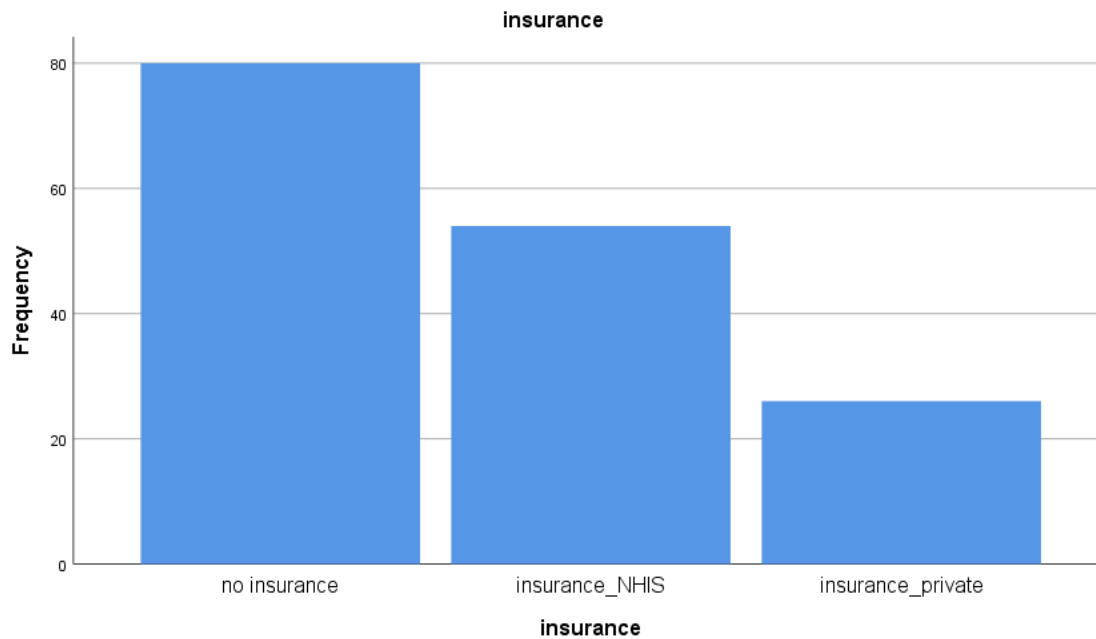
Following ethical approval, a formal introduction of the research, its purpose, and its benefits were fully presented to potential subjects using the Participants' Information Sheet, and individual informed consent was obtained. An interviewer-administered questionnaire, designed by the researchers, was peer reviewed by two different researchers to establish face and content validity (Tsang et al., 2017) prior to data collection from eligible participants. Relevant sociodemographic information was collected in addition to health insurance status. HbA1c levels, used for glycemic control assessment, and other biomedical data were retrieved from the patients' clinical records, which were made available to the research team by the diabetes clinic staff. HbA1c was measured as a continuous variable but recoded to a binary variable. Values less than 7% were reported as good glycemic control, and values above this were reported as poor glycemic control (American Diabetes Association, 2018).

Statistical Analysis

Data collection was completed, and the data were then cleaned, sorted, and fed into SPSS version 25 (IBM, 2017). Binary logistic regression was used to test for association between the independent variable (health insurance status) and the dependent variable (glycemic control). The hypotheses tests were conducted at 5% level of significance.

Results

Insurance status in 160 participants was measured in three categories: no insurance—80 subjects; insured-public (NHIS)—54 subjects; and insured-private—26 subjects. Of the total 160 participants, 45 were males and 115 were females, with the ratio of males to females essentially 2:5 in the study sample. Their ages ranged 36–88 years with a mean of 58.7 +/- 10.4 years. The distribution of the participants according to health insurance status is illustrated in Figure 1.

Figure 1. *Distribution of Study Participants According to Health Insurance Status*

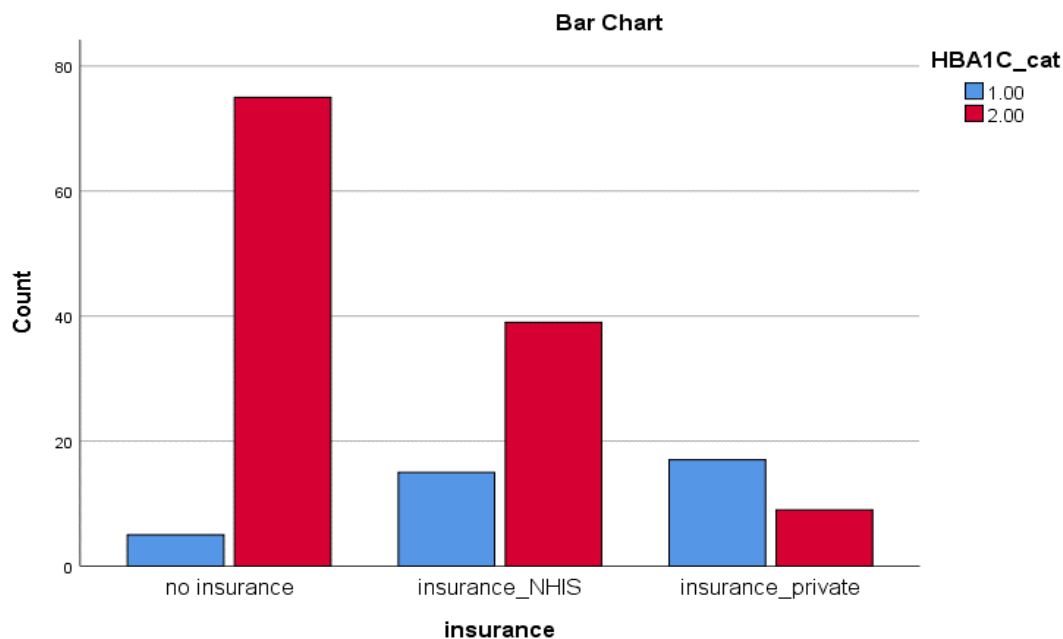
The distribution of glycemetic control among the participants according to their insurance status is shown in Table 1 below.

Table 1. *Pattern of Glycemic Control Among the Participants*

Variables		HbA1c_category		Total
		1.00 (good control)	2.00 (poor control)	
Insurance	No insurance	5	75	80
	Insurance-NHIS	15	39	54
	Insurance-Private	17	9	26
Total		37	123	160

Insurance and Glycemic Control

Among the patients without health insurance, the prevalence of poor glycemetic control was 93.8%, whereas in those with health insurance, the prevalence was 60.0%. Individuals on a private health insurance scheme had better glycemetic control as the prevalence of poor control was 34.6% compared with 72.2% for those accessing care under the public NHIS (see Figure 2, with red columns representing poor control and blue columns good control).

Figure 2. Illustration of Insurance and Glycemic Control

Logistic Regression Analysis

In comparison with insured subjects, a lack of health insurance coverage results in worsening glycemic control with increased odds or likelihood of 5.8 and 28.6, respectively, when compared with participants accessing care under the NHIS and private health insurance schemes. Regression analysis showed a statistically significant association between health insurance status and glycemic control (Table 2).

Table 2. Logistic Regression for Association Between Insurance and Poor Glycemic Control

Variables	B	S.E.	Wald	df	p-value	OR	95% CI	
							Lower	Upper
No insurance			29.24	2	<.001			
Insurance-NHIS	-1.75	.55	10.05	1	.002	.173	.059	.512
Insurance-Private	-3.34	.62	29.18	1	<.001	.035	.010	.119
Constant	-2.71	.46	34.38	1	.000	15.000		

Note. Reference category = No insurance; the results were significant, $X^2(2) = 38.291, p < .001$.

Discussion

The number of insured and uninsured participants in the study was equal at 80 each; as expected, the majority of the insured subjects were enrolled under the public NHIS, with the number just slightly more than double the number enrolled under the private insurance scheme. The prevalence of poor glycemic control in the patients without health insurance coverage was 93.8%, whereas in those with health insurance coverage,

the prevalence was 60.0%. These figures are notably high, taking into cognizance rates reported elsewhere globally. Of all the literature reviewed, the highest prevalence for poor glycemic control was reported in Owerri by Anoshirike et al. (2019), at 91.7%. This value, however, is less than the 93.8% noted in the uninsured subjects in our study, suggesting that glycemic control among diabetic subjects in Owerri is probably worsening. This is of great concern, considering that the deleterious effects of diabetes are linked to poor glycemic control. Individuals in the private scheme had better glycemic control, with the prevalence of poor control put at 34.6% compared with 72.2% for those accessing care under the public NHIS. Unpublished reports from many HMOs and HCPs suggest that the private insurance scheme in Nigeria is more efficiently run than NHIS. It is possible that subjects enrolled in the private scheme had better management approaches. A lack of health insurance coverage results in worsening glycemic control with increased odds or likelihood of 5.8 and 28.6, respectively, when compared with participants accessing care under the NHIA and private health insurance scheme. Our study, therefore, showed access to health insurance was found to be a determinant of glycemic control.

Our findings are consistent with several reports in the literature reviewed. A cross-sectional secondary analysis of diabetic patients in the National Health and Nutrition Examination Survey by Doucette et al. (2016) also concluded that access to health insurance was associated with improved diabetes management. An analysis of surveyed data by Dall et al. (2016) in the United States concluded that, among uninsured populations, there is more likelihood of undiagnosed diabetes compared with insured populations. Even after diagnosis, the uninsured are at risk of poor control of diabetes. Furthermore, Soumerai et al. reported as far back as 2004 that patients under an HMO had better glycemic control due to free glucose monitors, which led to an improved rate of self-monitoring. Perhaps the only contrasting report was by Jackson et al. (2016) in Switzerland, who found no difference in the control and quality of diabetes care among insured and uninsured patients. A reason for this finding could be the higher socioeconomic status of the participants in Switzerland, which may have enabled them to afford the cost of managing their type 2 DM regardless of access to health insurance.

Our study's outcome can be further explained using the ecosocial theory (Anderson, 2020), which is the theoretical framework for this research. Health insurance is a social factor, with our results suggesting that it is a predictor of glycemic control in diabetic subjects. Our results showed the conceptual understanding that health insurance, a social factor, interacts with and is integrated with biological mechanisms to affect glucose control in diabetic subjects, which is a biological phenomenon. This leads to either good or poor glycemic control in diabetic subjects, thus impacting the development of complications, attendant morbidity or mortality, and the health of populations. Our study outcome is further proof that social determinants of health are significant predictors of disease occurrence and progression. It yields evidence of the need for increased focus on theoretical conceptions that incorporate social factors to cause a clearer understanding of the causal relationships in disease distribution in epidemiology.

Available literature suggests that diabetes has been on the rise globally, with worsening morbidity and mortality, despite concerted efforts at improvement in community diagnosis and advances in treatment (Anioke et al., 2019; Haghighatpanah et al., 2018; Mahmood et al., 2016; Noor et al., 2017). Diabetes management, which essentially is good glycemic control, has remained largely unmet across diverse populations in different regions of the globe. Our study lends further evidence to this, as a majority of the respondents had poor glycemic control. We showed that access to health insurance is a predictor of glycemic control, with participants enrolled in health insurance schemes having a higher likelihood of good glycemic control compared with the uninsured subjects.

Private health insurance offers service in a stratified and discriminatory manner tied to extraneous factors such that, despite huge investments in health, many low-income earners, who constitute a significant proportion of the population, may not have access to healthcare in countries where private health insurance is dominant. Despite enrollees in the private scheme recording better glycemic control compared with enrollees

in the NHIA, emphasis on private over public health insurance schemes is discouraged. This is because private health insurance constitutes a health inequity and does not offer any potential for universal health coverage and improved public health. Nigeria can learn from the U.S. and strengthen the public health insurance scheme as an approach to mitigate the burden of not only diabetes but other disease conditions in the country. The U.S. is a nation with wide income inequity and wealth polarization. The U.S. emphasizes private health insurance schemes tied to employment, residency status, and incomes such that, despite huge investments in health, many low-income earners, predominantly African Americans and immigrants, have no access to health as the fees are not affordable (Ridic et al., 2012). The dominant effect of private over public health insurance in the U.S. is reported to be the key reason that health inequity is high in the country, which ranks poorly among Organization for Economic Cooperation and Development (OECD) countries. Notably, the U.S. is the only OECD nation without universal health coverage, despite boasting the highest investment in health and highest GDP among the OECD nations (OECD, 2023). In Nigeria, with poor healthcare expenditure and relatively low gross domestic product, it is thus appropriate to recommend that efforts be increased to advance the enrollment of populations into the NHIA as increasing membership in the private health insurance scheme cannot be sustained to achieve universal health coverage.

The law establishing the NHIA has broad provisions that can guarantee universal health coverage with programs such as the States Health Insurance Scheme, which will capture individuals in the formal sector under employment of the various state and local governments; and the Group, Individual, and Family Social Health Insurance Programme, which is a health insurance platform undertaken and paid for by groups, individuals, and families not covered by other NHIS coverage platforms. These are presently underutilized. Additionally, the NHIA can improve efficiency and HCP/client satisfaction by adopting common approaches used by the private health insurance scheme providers, such as regular tariff review in line with existing economic dynamics and market forces in the country; technological innovations that allow real-time enrollee validation, check-in, preauthorization request and approval; and ease with claims computation and submission. Further areas of change of the NHIA compared with the private scheme providers are reduction in the volume of service denial to enrollees and downward vetting of claims of approved care, and timely payment of claims, thus, reducing huge debts owed most HCPs.

Health insurance coverage plans should include diabetes preventive and control services capturing two key schedules: (1) free glucometer with regular supply of test strips to patients and (2) monthly refill of diabetic medications/insulin. Adoption of this as a policy thrust will serve as a veritable endpoint derivable from our study outcome. A systematic review of more than 600 articles across Asia, Latin America, and Africa showed that diabetes is a costly disease to manage in low- and middle-income countries (Moucheraud et al., 2019). We assert that the rising burden of diabetes in low- and middle-income countries places a financial strain on individuals and health systems. Therefore, it should be a priority at the upstream level for the formulation of policies that will ensure massive enrollment of Nigerians in the NHIA. The literature is replete with studies on DM, yet the prevalence of the disease continues to rise on an exponential projection with a worsening rate of complications. This suggests that DM demands more attention, more time, more resources, and more studies. Our research has contributed greatly by providing knowledge on another aspect of diabetes control hitherto overlooked. We have shown that NHIA enrollees have increased odds for good glycemic control relative to uninsured subjects and that advancing the scheme into an efficient and effective agency and service provider is a sure way to promote positive social change by causing a reduction in diabetes-associated morbidity and mortality leading to improved public health.

Limitations

An interviewer-administered questionnaire was used to collect data from the participants upon completion of an informed consent process. This questionnaire addressed health insurance status and type of health insurance coverage. Caution should be exercised in generalizability of the study findings beyond Owerri as the

study sample was drawn from diabetic subjects attending the Federal Medical Centre, Owerri only, excluding other health facilities in Imo State that offer service to diabetic patients.

Conclusion

Our study has shown that insured enrollees have an increased likelihood of good glycemic control relative to uninsured subjects. This drives advocacy for the incorporation of enabling regulations and design of policies on the NHIA scheme to explicitly cover diabetes preventive and control services with the objective of achieving an improvement in the glycemic control of individuals with the disease. Furthermore, efforts should be strengthened at all levels of influence to ensure mandatory enrollment of residents in Nigeria and other low-resource nations into the public health insurance scheme with the target of universal health coverage. This is the major challenge facing the NHIA.

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