

Economic burden of glaucoma in Nigeria: Estimating the direct health care cost in a tertiary eye clinic

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Abstract

Aim: To estimate the direct health care cost of glaucoma in patients attending glaucoma clinic at National Eye Centre, Kaduna. **Methods:** The study was a hospital-based observational, cross-sectional study of 150 consecutive glaucoma patients on follow-up visits to the glaucoma clinic from November, 2017 to January, 2018. The study was conducted using a structured interviewer-administered questionnaire. The study investigated the patients' monthly income, the method of funding glaucoma treatment, and cost of treatment of glaucoma. Data obtained were entered and analyzed using SPSS version 24 with level of significance set at 95% confidence interval. **Results:** There were a total of 150 patients who participated in the study, with a male-to-female ratio of M:F ratio is 1.2:1. Majority of respondents (65%) in the study were below the age of 60 years with a mean age of 55.36 (SD+/-13.7). The average monthly income of respondents was NGN 4,600 for unskilled workers, NGN 28,812 for skilled workers, and NGN 97,111 for professionals. The mean monthly direct health cost was NGN 9,954 and majority (91.7%) of the patients fund their treatment out of pocket. Only 14 (9.3%) patients were subscribers of the National Health Insurance Scheme. None among the unskilled and unemployed respondents had monthly direct costs below their average monthly income. The insured patients spent an average of 1.5% and 4.5%, respectively of their total monthly income on antiglaucoma medication and glaucoma surgery unlike the uninsured group who have spent 10.1% and 10.5%, respectively on medications and surgery. **Conclusion:** Data from this study have shown that up to one-tenth of the monthly income can be spent on glaucoma care alone. Health policy makers should consider making glaucoma a priority disease to ensure that patients on treatment have affordable, equitable, and of good quality in order to prevent consequent glaucoma-related blindness.

Keywords: Cost of glaucoma care, direct health care cost, economic burden, glaucoma

INTRODUCTION

Glaucoma represents a group of diseases defined by characteristic optic neuropathy that is consistent with excavation and undermining of the neural and connective tissue elements of the optic disc, resulting in the development of distinctive patterns of visual dysfunction. Although elevated intraocular pressure is one of the primary risk factors for glaucoma; however, it doesn't define the disease.^[1] Globally, it is a major public health problem being the leading cause of irreversible blindness and second only to cataract as a cause of blindness.^[2] It is popularly called "the silent thief of sight".^[3] In 2010, an estimated 60.5 million people were affected globally. This was extrapolated to 79.6 million by 2020 and 111.8 million by 2040.^[4]

Access to quality glaucoma care at an early stage of the disease can be determined by individual socioeconomic status (SES).^[5,6] Studies in Taiwan and Scotland suggest that individuals of higher SES are more likely to be diagnosed with primary open-angle glaucoma (POAG) at an earlier stage than individuals of lower SES due to differences in access to quality care.^[5,6] In Nigeria, studies reported that

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glaucoma patients commonly present to hospital at an advanced stage of the disease when one or both eyes are already blind.^[7] Ability to fund care is a key determinant of access to any form of health care. In Nigeria, a low- and middle-income country, citizens are generally of low SES, access to health care is an issue and financing glaucoma care is mainly out of pocket due to the existing inefficiencies in our health insurance system and suboptimal coverage.^[8,9] Given the magnitude of glaucoma in Nigeria, and the drawbacks of out-of-pocket payment (OOP) on individual's income and family budget, a study to appraise the direct cost of this disease on individual and family resources is important to provide data for advocacy and comprehensive budgetary planning for eye care in Nigeria and Africa.

Glaucoma as a chronic disease and the leading cause of irreversible blindness is expected to be a major cause of health care expenditure. A report in Ireland estimated that visual impairment and blindness cost the Irish government \$134.6 million in 2010, which was projected to be up to \$147.32 million by 2015 and \$158.7 million by 2020.^[10] Antiglaucoma drugs alone accounted for \$12.5 million in 2010, \$13.7 million in 2015, and projected to reach \$14.6 million by 2020.^[10] In India, the individual financial burden was noted to be more on low-income earners as they spend a higher percentage (13.41–18.36%) of their monthly income on antiglaucoma medications, whereas middle- and high-income earners spend lesser percentage (6.49–7.22% and 1.35–2.33%, respectively) of their monthly income on antiglaucoma medications.^[11] According to a study in Rivers state, Nigeria, the total (direct and indirect) monthly cost of glaucoma care was estimated to exceed the monthly wage of low-income earners, whereas middle-income earners spend approximately 50% of their monthly income on glaucoma care.^[12] Any illness with a financial burden greater than 40% of the household income is catastrophic and likely to have a negative impact on the family finances and may require stressful adjustments.^[13] If this burden is beyond the patient's income, coping strategies such as borrowing or assets sale to finance the health needs will be adopted.^[12-15] In such situations, some people may resign to fate. Meanwhile, as in 2017, the average wage for an employee in Nigeria was N1, 404 (\$3.9) per day or N504, 440 (\$14, 04)\$ per year, which is little to run a home and also cater for medical needs.^[14]

This study aims at estimating the direct health care cost of glaucoma treatment on patients in the glaucoma clinic of National Eye Centre, Kaduna. It also hopes to address the paucity of data especially in the northern part of the country and to aid evidence-based advocacy for financing glaucoma care in particular and eye care in general in Nigeria.

METHODS

This was a hospital-based study among patients attending the glaucoma subspecialty clinic of the National Eye Centre, Kaduna (NEC). Following ethical approval by the Research

and Ethics committee of the hospital, 150 outpatients were consecutively recruited in a purposive manner from November, 2017 to January, 2018. Tenets of the Helsinki declaration were followed.^[14] A pilot study was conducted at the ophthalmology department of Barau Dikko Teaching hospital, Kaduna, where the original questionnaire was pretested, adjusted, and validated for the study. Sample size was calculated using the Cochran formula.^[16]

$$N = Z^2 pq/d^2$$

where:

N = minimum sample size

p = 0.094 prevalence of glaucoma in a Nigerian hospital^[17]

q = 1-p = 0.906 (proportion of population without glaucoma)

Z = standard normal deviation at 95% confidence interval = 1.96

d = precision = 0.05

$$N = 1.962 \times 0.094 \times 0.906 / 0.052 = 130$$

Hence; $n^* = n/\text{response rate}$

$n = 130$, response rate = 90% or 0.9, because you have put non response at 10%

$$n^* = 130/0.9 = 144.4 = 145$$

Sample size will be 145 rounded to 150

Patients aged 18 years and above, already diagnosed with POAG by the specialist and on follow-up in the department were included. Although patients with significant ocular comorbidity (such as age-related macular degeneration and diabetic retinopathy) whose management could affect the cost of eye care were excluded from the study.

Before patient selection, patient's records were reviewed to ensure eligibility for inclusion as noted above. An adapted, annotated, and pretested questionnaire was administered to the respondents.^[18] It contained both open- and closed-ended questions. It was divided into sections seeking information on sociodemographic characteristics and direct medical cost (medical and surgical treatment). Other components of the questionnaire are as shown in the appendix. For patients working in established government institutions or private companies, their monthly wages were used as their monthly income. For respondents with daily income like petty-traders or shop owners with daily earnings, the monthly income was calculated by multiplying average earnings per day by 30 days. The respondent's occupational grouping was done using the International Standard of Classification of Occupations 2008 (ISCO-08). These groups of occupations of ISCO-08 are used to classify occupations into the different socioeconomic scale of Kuppaswamy Socioeconomic Classification.^[19] The unskilled class are for those with elementary occupations with skill level 1 such as cleaners and helpers at home, office,

and hotels.^[20] The skilled occupations are the clerical support workers, service and sale workers, skilled agricultural workers, craft and related workers, plants and machine assembly workers on skill level 2. The professional occupation classes are those groups such as professionals, managers, and associate professionals and technical occupations that are on skill level 3 and 4.^[21] The unemployed group are those without any income earning. Information regarding glaucoma treatment, resource utilization, and cost incurred on glaucoma care were obtained. The cost of investigations and consultation done during the follow-up or within the last month prior to the interview was requested. The usual investigations that patients did were the central visual field testing (CVF), optical coherence tomography (OCT), ultrasound biomicroscopy (UBM), refraction and B-scan. Printout copies of CVF, OCT, B scan and UBM were displayed to respondents to aid their recall. The cost of consultation in the hospital includes intraocular pressure measurement, gonioscopy, and ocular phasing.

Enquiries were made on the number and type of antiglaucoma drugs respondents were using. Empty bottles of the antiglaucoma drugs were displayed to aid recall for those that didn't come with their medication bottles or couldn't recall the name. The cost of antiglaucoma medication in the last month was asked. The drug cost was based on respondent's stated drug price for those who could recall the price, but for those unable to recall, the hospital pharmacy pricing for the medications was used. The unit cost of consultation and investigation was based on hospital user charges. If they had surgery or laser procedures related to glaucoma, the type of procedure and the cost of the procedure, cost of preoperative and postoperative medications were inquired about.

Study definitions:

- (1) Direct health care cost – the total OOP made on medical services (booking, hospital cards, records charges, consultation fee, cost of medications and all procedures, investigations etc.) in the course of seeking health care.
- (2) Direct nonmedical (non-health care) cost – OOP made on transportation, feeding, and accommodation in the course of seeking health care service.
- (3) Indirect cost – this is the cost of the forgone alternative as a consequence of seeking health care (for this context its glaucoma care). This includes time and finances lost by respondent and companion as they seek care. Expenses incurred from the cessation or reduction of work productivity as a result of the morbidity in glaucoma care.

Data were coded and entered and stored electronically using Statistical package for social sciences (SPSS) version 24. It was then checked for completeness, cleaned, and analyzed using the same software. Descriptive variables were summarized as frequency distributions, whereas inferential

statistics was done using chi-square test and independent *T*-test to show the associations between variables at a level of significance of $P < 0.05$.

RESULTS

A total of 150 glaucoma follow-up patients participated in the study of whom 81 (54%) were males (F:M = 1:1.2). Ninety seven (65%) of the respondents were below 60 years, with a mean age of 55.36 ± 13.7 SD. Majority (88.7%) of the respondents had formal education.

Breakdown of the average monthly cost of glaucoma medications [Tables 1 and 2]:

Majority of the patients 148 (98.6%) were on antiglaucoma medications, with a majority (38%) on two medications. There is a statistically significant relationship between direct health care cost and the number of medications used ($X^2 = 373.4$; df 164, $p = 0.00000$). Patients on monotherapy with timolol had the least mean monthly drug cost of Naira640 (\$1.8), whereas patients on a combination of three drugs (Timolol, Dorzolamide and Latanoprost) had the highest mean monthly drug cost of Naira6761 (\$18.8).

Analysis of the average monthly cost of antiglaucoma medications by their number [Table 3]. The mean drug cost for respondents on one medication was Naira1968 (\$5.5) and for those on three medications was Naira6808 (\$18.1).

Table 1: Sociodemographic Characteristics

Characteristics	Frequency	Percentage
Age group		
30 and below	4	2.7
31–40	28	18.7
41 – 50	24	16.0
51 – 60	41	27.3
61 – 70	31	20.7
70 and above	22	14.7
Total	150	100.0
Gender		
Male	81	54.0
Female	69	46.0
Total	150	100.0
Educational level		
Quranic/Informal	20	13.3
Primary level	27	18.0
Secondary level	23	15.3
Tertiary level	63	42.0
None	17	11.3
Total	150	100.0
Occupation		
Professionals	54	36.0
Skilled	46	30.7
Unskilled	21	14.0
Unemployed	29	19.3
Total	150	100.0

Table 2: Type and Number of Antiglaucoma Medications Patients are Using and Their Average Monthly Cost

Type of drugs	Frequency (%)	Mean Naira (Dollar)	SD
#None	2	.00	.000
Monotherapy			
Timolol	32 (21.3)	640.63 (1.8)	135.8
Betaxolol	5 (3.3)	1860.00 (5.2)	477.493
Travoprost	3 (2.0)	4166.6 (11.6)	288.6
Latanoprost	12 (8.0)	4541.6 (12.6)	450.1
*Others	3 (2.00)	6166.00 (17.1)	2466.4
Subtotal	55		
Two-drug combination			
Latanoprost and timolol	14	4778.5 (13.3)	1174.1
Timolol and dorzolamide	37 (24.7)	4345.9 (12.1)	994.0
Acetazolamide and others	1 (0.7)	2300.0 (6.4)	.
Betaxolol and latanoprost	2 (1.3)	7250.0 (20.1)	353.5
Travoprost and Timolol	2 (1.3)	4500.0 (12.5)	
Subtotal	56		
Three-drug combination			
Timolol, dorzolamide, and others	1 (0.7)	8500.00 (23.6)	.
Timolol, dorzolamide, and latanoprost	36 (24.0)	6761.1 (18.8)	2375.8
Subtotal	37		

*Pilocarpine, Brimonidine. All Dollar values were calculated at the currency conversion rate of Naira 360 at the time of study

Table 3: Monthly Cost of Antiglaucoma Medications by Their Numbers

Number of drugs	N	Range Naira (Dollar)	Minimum Naira (Dollar)	Maximum Naira (Dollar)	Mean Naira (Dollar)	SD
0	2	0	0	0	0	.000
1	55	4550(12.6)	450(1.3)	5000(13.9)	1968.52(5.5)	1790.5
2	56	6700(18.6)	2300(6.4)	9000(25.0)	4605.26(12.8)	1303.6
3	37	8400(23.3)	1100(3.1)	9500(26.4)	6808.11(18.9)	2360.0

Analysis of investigations shows that thirty-seven (24.3%) respondents have had CVF, 20 (13.3%) have done a refraction, whereas 8 (5.3%) had other glaucoma investigations such as B-scan, OCT, and UBM done at the present follow-up or within a month.

Twenty-one (14.0%) of the respondents had undergone glaucoma-related surgeries. Patients may be on glaucoma medications but also had undergone glaucoma surgery.

Majority of the respondents who underwent surgery (76.2%) had trabeculectomy with a mean surgical cost of Naira28125.2 (\$78.1). Using an independent sample *t*-test, there is a statistically significant difference between the cost of medications and surgery *t*-test ($t=38.378$; $df=165$; $p=0.000$). Analysis of beneficiaries of health insurance by their occupation [Figure 1] shows that 14 respondents (9.3%) benefitted from health insurance. A majority (64.3%) of beneficiaries were professionals, whereas the remaining 5 (35.7%) were in the skilled group. None in the unemployed or unskilled group had health insurance as shown in [Figure 2]. The unemployed and unskilled respondents spent more for direct health care cost of glaucoma treatment than their average monthly income.

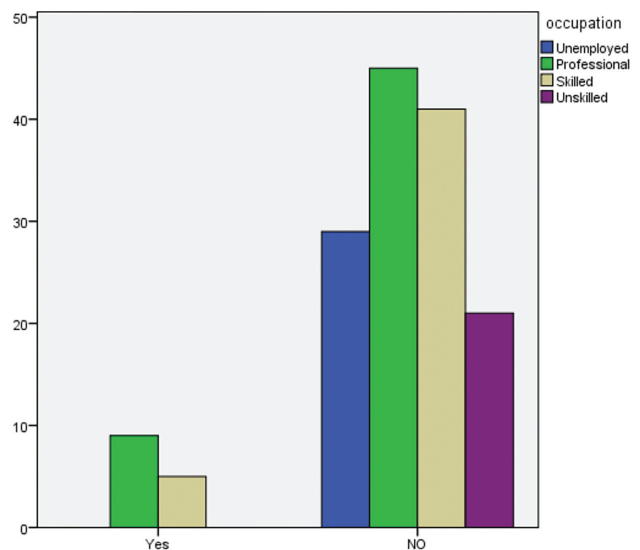


Figure 1: Health insurance beneficiaries by occupation.

Whereas the professionals and the skilled workers spent less than their total monthly income as shown in Figure 2.

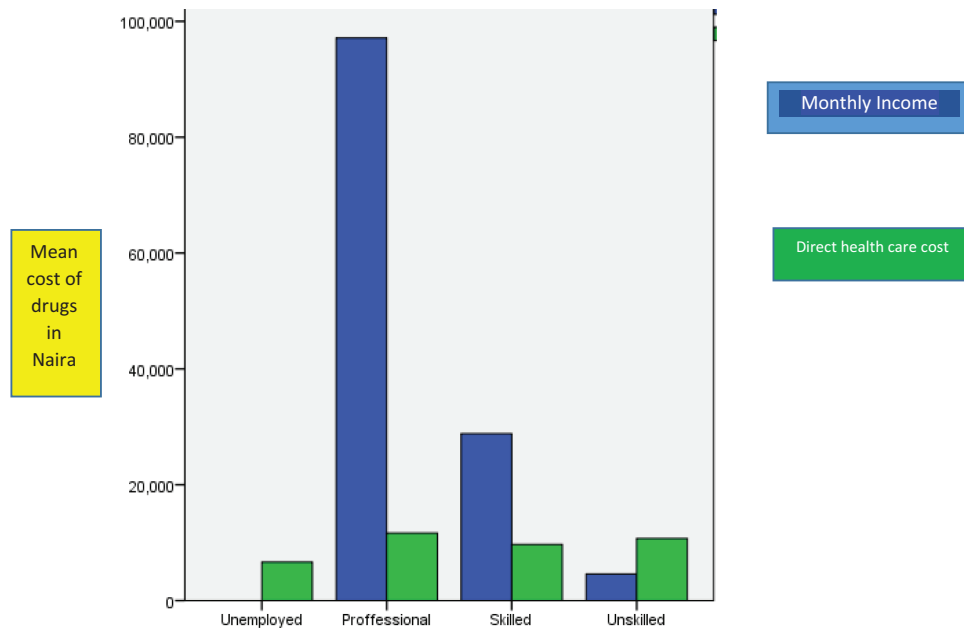


Figure 2: Comparison of the mean of patients' monthly income by their occupation and mean monthly direct cost.

Table 4: Comparisons of Cost of Glaucoma Care between the Insured and Noninsured Patient

Characteristics	INSURED PATIENTS				NONINSURED PATIENTS			
	N	SUM (*)	MEAN (*)	SD (*)	N	SUM (*)	MEAN (*)	SD (*)
Monthly income	14	968996	69214	21141	136	5696904	41889	66940
Drug cost	14	45 192	3228.	3353.	136	575500	4231	2540
Surgery cost	4	14000	3500	.000	17	525000	30882	9879

*Naira (NGN)

Almost a half (48.7%) of the respondents paid for their treatment themselves, whereas other important contributors were as represented in [Table 4].

The average monthly cost of medications for the insured was Naira3228.6, whereas the uninsured spent Naira4231. The mean cost of surgery for the insured was Naira3500, whereas the uninsured spent Naira30,888.2 as shown in Table 4. The table shows the total cost for specific aspects of glaucoma care and sum of total monthly income in the two categories of respondents. This shows that the insured respondents spent only 4.7% and 1.4% of their monthly income on antiglaucoma drugs and glaucoma surgery, respectively as against 10.1% and 10.0%, respectively in the uninsured patients.

The unemployed and unskilled respondents spent more for direct health care cost of glaucoma treatment than their average monthly income. Whereas the professionals and the skilled workers spent less than their total monthly income as shown in Figure 2.

[Figure 3] showing the different health care costs

Analysis of the components of the economic burden of glaucoma (Figure 3) shows the mean direct health care cost per patient per month was Naira9,954 (\$27.7),

whereas direct nonhealth cost was Naira2,730 (\$7.6) and the indirect cost was Naira1942 (\$5.4).

DISCUSSION

About two-thirds of the study respondents were aged below 60 years. This is similar to what was earlier reported by Adio and Onua where 60% were less than 60 years.^[12] Conversely, a similar study in UK reported a mean age of 69.9 ± 12.6 SD. This is in keeping with what is previously known that glaucoma presents earlier in blacks compared to Caucasians. There was a slight male preponderance in this study, this might be linked to the slightly higher male preponderance of glaucoma among males in Nigeria.^[22] On the other hand, a similar hospital-based study in Port-Harcourt reported a female preponderance.^[12] About a third of participants were either unemployed or unskilled workers. This suggests a low economic status which translates to poor access to quality glaucoma care,^[6] especially considering that less than 10% of the study participants had health insurance (Table 4). None of the unemployed or unskilled had any form of insurance coverage.

From the foregoing, the results showed that an overwhelming majority of study respondents accessed care through OOP.

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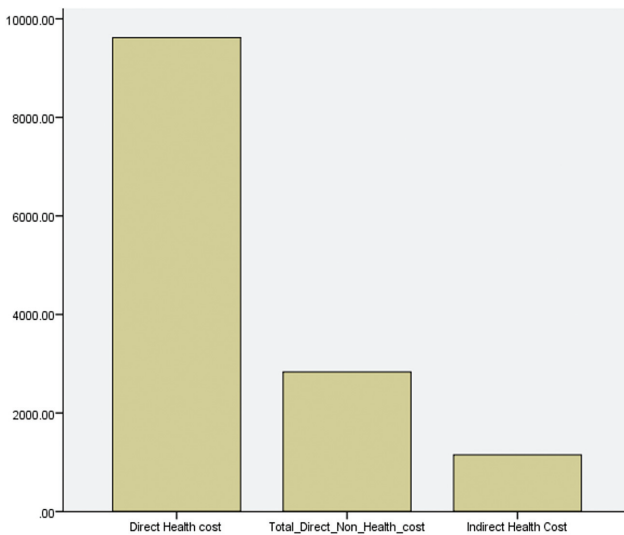


Figure 3: Showing the different proportion of the different health costs among respondents.

Table 5: Sources of Funding for Glaucoma Treatment Among Respondents

Who Paid for Medication	Frequency	Percent
Myself	73	48.7
My children	41	27.3
My religious body	2	1.3
Health insurance	14	9.3
Relatives	11	7.3
*Others	9	6.0
Total	150	100.0

*Neighbor, Friends.

An even worse situation was reported by Adio and Onua where all their study participants accessed glaucoma care through OOP.^[12] These points corroborate what is known through reports by the WHO and other stakeholders.

In Nigeria, for every one Naira of care paid for through insurance, nine are paid OOP, particularly for surgical costs. Certain medications preferred by the physicians were not covered by the insurance package or such medication was not available. This highlights one of the few areas in our health insurance system that requires improvement.

The average direct cost of glaucoma treatment to a patient was estimated at Naira8146.7 (US\$21.3) per month in this study. Antiglaucoma medication (about 40%) and surgery constituted a bulk of this direct health cost. This fits into earlier studies that reported between 42 and 57% with individual variations within a study.^[23-25] The reason for these variations was due to differences in number and prices of medications that may be single agents (like timolol, betaxolol, latanoprost, etc.) or fixed combinations like (Latanoprost + timolol, dorzolamide + timolol, brinzolamide + brimonidine, etc.), or brands or generics. Respondents on monotherapy had the least-expensive average monthly drug cost, whereas patients on two drugs

or three drugs had a more-expensive average monthly cost of medications, similar to other studies where the monthly cost of medications for patients on monotherapy was Naira1,690 (US\$4.7), whereas patients on two drugs and three-drug combinations spent about Naira3,380 (US\$9.4) and Naira4,160 (US\$11.5), respectively.^[26] There were also differences in the average monthly cost of medications to respondents depending on the type of medications patients were receiving for treatment. Respondents on Timolol (nonselective B blocker) had the least average monthly cost of medication similar to another study where the monthly cost was Naira400 (\$1.1), whereas patients on prostaglandins analogs spent between Naira2,700 and Naira4,500 (US\$7.82–US\$12.5). In Ghana, the average monthly cost for glaucoma medication in three tertiary referral eye facilities was \$40.^[27] This also was considered very high given that the monthly minimum wage at the time of the study was \$60. Compared to the mean monthly cost in Nigeria, the mean cost in Ghana was about double the highest mean monthly medication cost in Nigeria. Possible reason for this was National Eye Centre, a government-owned facility where costs were being subsidized unlike two of the facilities considered in Ghana. Also, the monthly minimum wage in Nigeria at the time of this study was Naira18,000 (\$50). Unfortunately, further comparison would be difficult as the Ghanaian study, which was a retrospective, cross-sectional study, while the index study considered estimates at the time [Table 5].

Results from Table 4 show that average direct cost of glaucoma care could be as low as 1.4% and 10% of monthly income. The former figure was for the insured glaucoma patients who accounted for 9.3% of the study population, whereas the latter represent average expenditure for those without insurance coverage. Spending 10% of monthly income as part of direct cost for glaucoma care alone is not sustainable and already a recipe for catastrophic health expenditure. Almost 80% of respondents in this study are above 40 years. This is an age bracket associated with comorbidities and if one spends 10% of income for glaucoma care alone, other possible ocular and systemic morbidities. Furthermore, about 40% are at the retirement age, some of whom are within the 33% either unskilled or unemployed. Also this study, though the unemployed had no income to compare their medical expenses with, the unskilled workers had to pay more than their average monthly income on direct health care cost, the skilled workers spent a mean of slightly above a third of their monthly income on the same (which is still not sustainable). All these qualify as catastrophic health expenditure which are very potent triggers for impoverishment. On the other hand, highly skilled professionals spend about a 10th of their monthly income on glaucoma care. Incidentally, this is the same group that has access to health risk protection. Over 90% of expenditure estimates were OOP. Though this differs from the report of an earlier systematic review by Uzochukwu *et al.*,^[28] which

reported an unacceptable 70%. However, both figures (70 and 90%) are unsustainable for health care and have remained the bane of an abysmally low access to health care in Nigeria. It is only logical to think that one who has to pay more than 30% of his monthly income on only glaucoma care will definitely default and resign to fate or other alternative care portals. Potential limitations of this study include the fact that the study did not assess the variation of cost of glaucoma with progression. This may provide insight on the differences in the cost of treatment of early and late stages of glaucoma. Also, the study assessed the monthly income of respondents and not households. Household income may have provided in-depth information of the burden of glaucoma in the household. In calculating the average monthly income of respondents, it was assumed that all worked 30 days a week. This could have been a faulty assumption as the majority of people do not work 30 days a month in reality.

CONCLUSIONS/RECOMMENDATIONS

This study has demonstrated that an overwhelming majority of the respondents finance their glaucoma treatment OOP. Health insurance uptake was very low among the respondents, mainly limited to professional privileged groups. Also, direct health care cost accounted for a higher proportion of the economic burden of glaucoma to patients when compared to direct non-health care costs as well as the indirect costs.

Out-of-pocket payment is not compatible with universal health coverage. Stakeholders need to devise sustainable ways of providing health risk protection to teeming Nigerians who cannot afford to fund their glaucoma care and other aspects of health care OOP.

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Conflicts of interest

There are no conflicts of interest.

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