The Effect of Direct Health Education on the Uptake of Screening by First Degree Relatives of Glaucoma Patients in Nigeria

Olakunle Ogunleye, MD, FMCOph,* Olusola Olawoye, MD, FWACS,**† Tarela Sarimuye, MD, FWACS,**† Charles Bekibele, MD, FWACS,**† and Adeyinka Ashaye, MD, FWACS**†

Précis: First degree relatives (FDRs) of glaucoma patients are more likely to present for screening when they are directly contacted and educated by health workers on the phone compared with when they are only invited by their relative with glaucoma.

Objective: The aim was to determine the effect of direct health education by phone calls on the uptake of glaucoma screening among FDRs of primary open angle glaucoma patients as a glaucoma blindness control strategy in an asymptomatic high-risk African population.

Methods: This was a randomized clinical trial in which 102 primary open angle glaucoma patients (probands) were randomized into control and intervention groups. Both proband groups were educated about glaucoma and requested by the investigator to invite their adult FDR to attend a screening clinic within 1 month. In addition, the FDRs in the intervention group were directly contacted, educated, and invited for examination by phone calls. A total of 360 FDRs were enumerated by the probands. The main outcome measure was proportion of FDR that presented for screening.

Results: A total of 218 (38.9%) FDRs took up glaucoma screening services. Eighty-nine (30.1%) of the 296 FDRs in the control group and 129 (48.9%) of the 264 FDRs in the intervention group presented for examination. After multivariate analysis, FDRs in the phone call group were 2.506 times [95% confidence interval (CI): 1.695-3.706] more likely to present than FDRs in the no phone call group. Young FDRs were more likely to present [odds ratio (OR) = 3.593; 95% CI: 1.613-8.007] than the elderly FDRs, while FDRs living within 200 km of the hospital were also more likely to present (OR = 5.200; 95% CI: 2.860-9.456) than those living far (>200 km) away. Probands with moderate to severe visual impairment were significantly more likely (OR = 3.073; 95% CI: 1.845-4.352) to have their FDRs present than probands with mild or no visual impairment.

Conclusion: Direct contact and health education of FDRs through phone calls had a significant positive effect on the uptake of glaucoma screening by FDRs. We recommend direct contact and education of the FDRs of glaucoma patients.

Key Words: glaucoma, screening, first degree relatives (J Glaucoma 2021;30:395-401)

Glaucoma is the second leading cause of blindness and the leading cause of irreversible blindness worldwide.1-3 Over 8 million people worldwide were estimated to be bilaterally blind from glaucoma in 2010 and this figure was expected to increase to over 11 million by 2020.3 Worldwide, primary open angle glaucoma (POAG) is the most common type of glaucoma and accounts for about 3-quarters (74%) of all cases of glaucoma and about half of bilateral blindness from glaucoma.2 Globally, in 2015, POAG was estimated to affect 57.5 million people and this was expected to rise to 65.5 million by 2020.1 The prevalence of POAG is highest in Africa and amongst people of African ancestry.2 Population-based studies in South West Nigeria reported a prevalence of 6.9%,4 while a country-wide prevalence study reported a glaucoma prevalence of 5.02%, with the highest prevalence reported in the South Eastern region of the country.5 Glaucoma, therefore, is a disease of public health importance in Nigeria. It is responsible for 16.7% of blindness and it affects 1 in every 20 persons 40 years and above.5

Glaucoma is asymptomatic in the early stages, with many presenting for the first time with vision loss or advanced disease.6-8 More than 90% of individuals with glaucoma in Nigeria are unaware of their disease status.5,8 The remaining 10% who are diagnosed already have very advanced disease at presentation to the health facilities, with its attendant socio-economic consequences.

Considering the high prevalence of glaucoma and glaucoma blindness in sub-Saharan Africa (SSA), there is a need to develop cost-effective methods to improve case detection and screening of glaucoma in SSA to reduce needless blindness from the disease. Low-cost opportunistic screening can help to detect glaucoma in its early stages when treatment is more effective. Detecting glaucoma in the early stages reduces the incidence of glaucoma blindness, vision loss and morbidity from the disease. It may also improve the quality of life of patients who are detected early and reduce glaucoma-related health care expenditure. Studies have reported that population-based screening is not cost effective.9 However, case detection of at-risk groups such as Africans, Hispanics, the elderly population and those with a family history of glaucoma is useful in the early detection of glaucoma.9,10 Consequently, screening for POAG has been found to be more cost and clinically effective when directed at high-risk populations.11
Family history of glaucoma has been reported to be an important risk factor. Studies suggest that those with a positive family history of glaucoma are 3 times more likely to develop open angle glaucoma. Therefore, there is an increased prevalence of glaucoma among the FDRs of glaucoma patients. Population studies estimate a risk ratio of 9.2. The first degree relatives (FDRs) of patients with glaucoma represent an important at-risk population that would benefit from screening and early detection of the disease.

Reducing the burden of blindness from glaucoma will require actively searching out these presymptomatic family members of individuals with POAG to detect the disease early and commence treatment on them to prevent blindness. Educating FDRs and getting them to come for screening in large numbers would lead to higher rates of detection of presymptomatic disease, which may lead to the early commencement of treatment, and ultimately a reduction in the burden of blindness from glaucoma.

An important step, however, is ensuring that FDRs take up screening services. The uptake of screening services has been noted to be poor in developing nations even when the service is free, with 8.1% uptake reported in Tanzania and 7% in India. A study in Nigeria among POAG patients noted that only 32.2% of patients with a family history of glaucoma reported that some of their relatives had undergone glaucoma screening. This was, however, a subjective patient report, which was subject to bias.

There are suggestions that this poor uptake may be due in part to reliance on index patients (probands) to educate and invite relatives for screening. One strategy to address this and improve uptake could therefore be the use of health workers to directly contact, educate, and invite the FDRs of individuals with POAG for screening. This could be done through phone calls. The use of phone calls and short message service texts have been reported to be effective in improving the clinic attendance of patients. About 9 in every 10 persons in Nigeria have a mobile phone, with over 150 million active phone subscribers.

We found no data or information in our environment (resource constrained with high prevalence of glaucoma) concerning how well relatives of glaucoma patients would respond to an invitation to get screened when contacted directly. This data is important for planning of screening services and to understand the additional benefits of direct phone calls. It is important to know how well these relatives would respond to screening invitations through the index patients and through hospital direct contact in our sociocultural environment. This is critical in determining if this is a worthwhile intervention strategy in resource constrained settings. We report the findings of our study which evaluated the feasibility and effectiveness of educational intervention by telephone contact to increase the uptake of glaucoma screening among FDRs whose contacts were provided by probands (glaucoma patients) receiving treatment at the University College Hospital (UCH), Ibadan.

**METHODS**

The study participants were POAG patients attending the Eye Clinic at the UCH, Ibadan. The patients were mainly from the southwest region of Nigeria, comprising largely the Yoruba tribe. Patients from the other major ethnic groups also attended the clinic. The glaucoma clinic has been in existence for over 35 years. Facilities for medical, surgical, and laser treatment are available in the clinic.

**Recruitment of Probands**

Consecutive consenting POAG patients on follow-up care (probands) were recruited from the Eye Clinic of the UCH, Ibadan, over a 6-month period, from December 2017 to May 2018.

A questionnaire was administered to all consenting probands, which detailed information regarding sociodemographic data, knowledge of diagnosis, time of diagnosis, mode of treatment, medical history, known family history of glaucoma, knowledge of high risk of disease in FDR, a past history of invitation to their FDR for glaucoma screening, if FDR has been screened, known reason why FDR had not been screened, and family tree with sociodemographic and contact details (including phone number) of FDR. Complete ocular examination was done.

All the probands were then randomized to 1 of 2 groups—a control group (group 1) and an intervention group (group 2)—by asking each proband to randomly pick 1 opaque sealed envelope indicating a group from a pack of similar envelopes. The probands were unaware of which group they belonged to and whether their FDR would be called or not. Randomization was done by an independent assistant to avoid bias.

All the probands (control and intervention) were requested to invite their FDR with a standardized invitation letter (including a contact phone number of 1 of the investigators) to attend a free screening appointment within 4 weeks of the probands recruitment.

**Recruitment of FDRs**

The FDRs were identified and enumerated with the aid of a family tree drawn by O.O. based on information from the probands. Construction of the tree highlighted monogamous and polygamous family settings. An FDR was defined as parents, full siblings or children of probands, 18 years old and above.

The group 2 FDRs (intervention group) were also directly contacted, educated and invited through standardized phone calls (Supplemental Digital Content Appendix 2, http://links.lww.com/IJG/A512).

**Baseline Surveys and Interventions**

Letters (Supplemental Digital Content Appendix 1, http://links.lww.com/IJG/A511) were written to all the FDRs individually. The name of the FDR was written on each envelope and handed over to the proband. There was no ceiling on the number of invited FDRs per proband. The FDRs living outside Nigeria were however excluded. Follow-up invitation phone calls with a standardized message (Supplemental Digital Content Appendix 2, http://links.lww.com/IJG/A512) were made once weekly by one investigator (allowing for uniformity) to the FDRs in group 2, for a maximum of 4 weeks from initial enumeration. Calls were stopped earlier only if the FDRs presented before the end of the 4-week duration or reported presenting elsewhere. The contents of initial and follow-up calls were guided by the standardized message and were essentially similar, but not prerecorded. The language of conversation on phone was guided by the FDR’s response (mostly in Yoruba and English language) and the FDRs were allowed to seek clarifications as needed. The tone of conversation was that of care and concern for their wellbeing. No limit was placed on call duration, but most calls lasted between 3 and 4 minutes. Calls were uniformly made in the evenings, targeting after-work hours. Information was obtained on their place of residence and whether they would like to be screened for glaucoma.
All the FDRs were asked to present at the Glaucoma FDR Screening Clinic with an invitation letter to facilitate the attention of the investigator.

All the FDRs who presented were administered questionnaires and examined. They were appropriately referred and registered for further evaluation and/or prescribed medications as necessary. The FDRs in the intervention group who did not present for screening within the stipulated period were contacted on phone to determine possible reasons for not presenting and further counseled on the need for examination.

The main outcome variable was the proportion of FDRs that presented for screening in the 2 groups at the end of 4 weeks.

### Statistical Analysis

Data collected was entered, cleaned, and analyzed by a statistician using the Statistical Package for Social Sciences (SPSS, version 21) software. Summary statistics were presented using frequency tables, charts, means, and rates. Odds ratio and $\chi^2$ tests were used to test for associations between variables (95% confidence interval). Bivariate and multiple logistic regression was also used as a test of association. Level of test significance was set at 0.05.

Ethical approval and clearance was obtained from the Health Research Ethics Committee of the UCH, Ibadan.

### RESULTS

A total of 102 probands were recruited during the study period. The total number of FDRs enrolled into the study was 560. The number of FDRs per proband ranged from 1 to 11.

In the proband population, there were 56 (54.9%) males and 46 (45.1%) females with ages ranging from 42 to 87 years (mean: 66.1 y). More than half of them (58.8%) had tertiary education and only 12 (11.8%) of them resided outside Ibadan (Table 1). Their duration of diagnosis ranged from 1 to 33 years with a median of 5 years. Presenting visual acuity in the better eye was 6/18 or better (normal/mild visual impairment) in 83 (81.4%) probands and worse than 3/60 in 6 (5.9%) probands. However, 36 (35.3%) probands had visual acuity of <3/60 in the worse eye while 56 (54.9%) had visual acuity of 6/18 or better in the worse eye with others having moderate to severe visual impairment (worse than 6/18 to 3/60) in the worse eye. The proband control and intervention groups were similar in terms of sex ($P=0.233$), educational level ($P=0.450$), marital status ($P=0.616$), and place of residence ($P=0.539$). The average age was 67.1 years in the control group and 65.1 years in the intervention group ($t$ test: 1.068; $P=0.288$). The sociodemographic characteristics of the probands are highlighted in Table 1 and are similar in the 2 groups.

Of the 560 FDRs enrolled into the study, 264 (47.1%) were in the phone call group and 296 (52.9%) were in the no phone call group. Thirty-nine of the FDRs in the phone call group (14.7%) could not be reached on phone, but their data was handled with an intention to treat analysis and not excluded. The sociodemographic characteristics of the FDRs are highlighted in Table 2 and are similar in the 2 groups. We also compared the mean age, sex, and place of residence before commencement of the study. The study adhered to the tenets of the Helsinki Declaration.

### TABLE 1. Sociodemographic Characteristics of all Probands by Randomized Group

| Sociodemographic Characteristics | Study Group |
|----------------------------------|-------------|
|                                  | No Phone Call | Phone Call | Total | $P$ |
| Mean age of proband              | 67.09 ± 9.41  | 65.07 ± 9.68 | 66.09 ± 9.55 | 0.288 |
| Sex                              |             |             |       |     |
| Male                             | 31 (60.8)   | 25 (49.0)   | 56 (54.9) | 0.233 |
| Female                           | 20 (39.2)   | 26 (51.0)   | 46 (45.1) |     |
| Educational level attained       |             |             |       |     |
| Nil                              | 5 (9.8)     | 2 (3.9)     | 7 (6.9)  | 0.450 |
| Primary                          | 5 (9.8)     | 6 (11.8)    | 11 (10.8) |     |
| Secondary                        | 14 (27.5)   | 10 (19.6)   | 24 (23.5) |     |
| Tertiary                         | 27 (52.9)   | 33 (64.7)   | 60 (58.8) |     |
| Marital status                   |             |             |       |     |
| Currently married                | 42 (82.4)   | 44 (86.3)   | 86 (84.3) | 0.616 |
| Widowed                          | 9 (17.6)    | 7 (13.7)    | 16 (15.7) |     |
| Place of residence               |             |             |       |     |
| Within Ibadan                    | 44 (86.3)   | 46 (90.2)   | 90 (88.2) | 0.539 |
| Outside Ibadan                   | 7 (13.7)    | 5 (9.8)     | 12 (11.8) |     |
| Duration of diagnosis (y)        |             |             |       |     |
| < 5                              | 29 (56.8)   | 29 (56.9)   | 58 (56.9) | 0.471 |
| 6-10                             | 11 (21.6)   | 15 (29.4)   | 26 (25.5) |     |
| > 10                             | 11 (21.6)   | 7 (13.7)    | 18 (17.6) |     |
| Presenting VA of better eye      |             |             |       |     |
| Normal/mild VI                   | 42 (82.4)   | 41 (80.4)   | 83 (81.4) | 0.685 |
| Moderate VI                      | 7 (13.7)    | 6 (11.8)    | 13 (12.7) |     |
| Blind                            | 2 (3.9)     | 4 (7.8)     | 6 (5.9)  |     |
| Presenting VA of worse eye       |             |             |       |     |
| Normal/mild VI                   | 26 (51.0)   | 30 (58.8)   | 56 (54.9) | 0.671 |
| Moderate VI                      | 6 (11.8)    | 4 (7.8)     | 10 (9.8)  |     |
| Blind                            | 19 (37.3)   | 17 (33.3)   | 36 (35.3) |     |
| Treatment                        |             |             |       |     |
| Medical                          | 36 (70.6)   | 41 (80.4)   | 77 (75.5) | 0.250 |
| Both medical and surgical        | 15 (29.4)   | 10 (19.6)   | 25 (24.5) |     |

VA indicates visual acuity; VI, visual impairment.
residence of all the FDR and probands. The mean age of the probands was 66.08 ± 9.55 while the mean age of the FDR was 42.54 ± 14.46. There was a statistically significant difference between the 2 groups (P < 0.001). About 70% of the FDR were offsprings of the probands and about 30% were siblings which may have been responsible for the lower mean age of the FDRs compared with the probands. There was no statistical difference in sex between the 2 groups (P = 0.35, Pearson $\chi^2 = 2.07$) and proximity to the hospital (P = 0.05, Pearson $\chi^2 = 9.49$).

Almost half (48.9%) of the FDRs randomized to the phone call group presented for examination as against about a third (30.1%) of the FDRs randomized to the no phone call group, which was found to be statistically significant (odds ratio = 2.22; 1.572-3.142) (P < 0.001) (Table 3).

Females were more likely to present for examination than males, as were FDRs in the young age group (< 45 y). The FDRs living within Ibadan were more likely to present than those living further away. Siblings and offspring were more likely to present for examination than parents (Table 4).

The associations between uptake of screening by FDR and the FDR or proband characteristics are depicted in Table 4. The age and place of residence of the FDR and the probands; and the educational status and presenting visual acuity in the better eye of the proband appeared to have an association with the presentation of the FDR (Table 4).

On multivariate analysis and adjusting for other variables, the statistical significance of tested associations is depicted in Table 5.

Reasons given by the FDRs who did not present for screening in the intervention (phone call) group included being busy (37.1%), long distance to screening center (34.6%), accessed examination elsewhere (12.8%), no felt need (10.3%), cost of transport (2.6%), lack of escort (1.3%), and fear of the hospital (1.3%).

About one-third (32.6%) of the presenting FDRs indicated that they had not heard about glaucoma before the invitation for this study. One hundred and eighty seven (85.8%) presenting FDR were aware of a family history of glaucoma. However, about a third (37.4%) of these got to know of the family history during the invitation for screening. Almost 3-quarters (70.6%) of the probands knew glaucoma could cause blindness and 60.8% of them knew the blindness was irreversible. More than 3-quarters (78.4%) knew that relatives were at a higher risk of developing glaucoma.

Only 21 (9.6%) of the presenting FDRs indicated they had been previously invited for glaucoma screening, while just 17 (7.8%) of them had their eyes tested for glaucoma previously. Four (1.8%) of the presenting FDRs were already on treatment for glaucoma at presentation.

### DISCUSSION

This study evaluated the effect of direct health education through phone calls on the uptake of glaucoma screening by the FDRs of glaucoma patients. It showed that direct phone calls increased the uptake of screening services, compared with the control group that had only letters of invitation. This finding suggests that this may be a useful way to increase the uptake of screening among high-risk populations in SSA.

The uptake of glaucoma screening observed in this study is higher than that recorded in similar studies in Africa and Asia. Munachonga et al in Tanzania reported a 10.1% uptake with free screening and letters of invitation. Rajendrababu and colleagues reported an uptake of 7% in India with free screening and invitation letters sent by mail. No phone calls to FDRs were made in both studies.

The better uptake reported in this study compared with the results in Tanzania and India could be a reflection of our study design. In this study, a contact phone number was indicated on the invitation letters, which allowed for prompt and personalized service in a FDR-dedicated clinic, unlike in the other studies. Also, the letters were not sent by mail, which could be less effective.

However, Vernon in the United Kingdom reported a 90% uptake following a single letter of invitation. This study in the United Kingdom had a better uptake possibly because of the proximity of all the invited FDRs, who were living within a 15-mile radius of the hospital.

The direct health education of FDRs through phone calls was associated with a statistically significant higher uptake of screening services (P < 0.001) in this study. Studies in other health conditions have demonstrated improved uptake of medical services with the use of voice calls and short message service services. Hirst et al in London noted an improved uptake of colorectal cancer screening (P < 0.02) among first time invitees who received text message reminders. McLean et al noted in their review that reminder systems with additional information such as health information may be useful in reducing non-attendance for first appointments and screening appointments. In this study, additional information was given about the irreversibility of blindness from glaucoma, unlike blindness from cataract which is reversible. We did not find any previous study that demonstrated the use of reminder systems with additional health information in glaucoma screening uptake.

In order to assess the possible factors influencing uptake, we tested the association of uptake with FDR and proband characteristics. Young-aged and middle-aged FDRs were more likely to present than the elderly. This may be because the younger age groups are more physically active, may be more economically empowered, and may also see the need to prevent future blindness considering their longer life expectancy. The elderly, on the other hand,
may not be so inclined especially when there are no major visual challenges at their advanced age. More than 3-quarters of the FDRs that presented were younger than 50 years of age and in the working age group.

The association of sex of the FDR with presentation was not statistically significant, although females were more likely to present. Studies have reported better health-seeking behavior in females than in males.26–28

Other psychosocial predictors of screening uptake not explored in this study may play a significant part. Future studies should explore these and appropriate interventions applied.

It was also noted in this study that more than 3-quarters of presenting FDRs were offspring of probands. One reason for this may be the mean age of the probands, which was 66.1 years. Offspring were more likely to be FDRs than parents and siblings in this setting.

There was a statistically significant association between place of residence of the FDR and uptake of screening. The FDRs living within Ibadan were more likely to present for examination. This is not unexpected as distance has been reported as a barrier to the uptake of medical services.29–31

The presenting visual acuity of the probands had an influence on the presentation of their FDR. Relatives of probands with moderate to severe visual impairment were more likely to present. This may be related to the first-hand demonstration of the impact of the disease in the family. A history of surgical intervention in the proband did not influence presentation. One might have

### TABLE 4. Association Between Uptake of Screening by FDR and FDR/Proband Characteristics

| Sociodemographic and Clinical Characteristics | Yes | No | OR (95% CI) | P |
|-----------------------------------------------|-----|----|-------------|---|
| **Sex of FDR**                                |     |    |             |   |
| Male                                          | 108 (35.4) | 197 (64.6) | 1 |  |
| Female                                        | 110 (43.1) | 145 (56.9) | 1.384 (0.984-1.947) | 0.062 |
| **Age of FDR (y)**                            |     |    |             |   |
| <45                                           | 151 (43.0) | 200 (57.0) | 2.642 (1.6279-5.505) | 0.009 |
| 45-65                                         | 57 (34.8) | 107 (65.2) | 1.864 (0.2861-4.038) | 0.114 |
| Above 65                                      | 10 (22.2) | 35 (77.8) | 1 |  |
| **Place of residence of FDR**                 |     |    |             |   |
| Within Ibadan                                  | 149 (53.2) | 131 (46.8) | 4.152 (2.401-7.178) | < 0.001 |
| Outside Ibadan (< 200 km)                      | 49 (26.2) | 138 (73.8) | 1.296 (0.2861-4.038) | 0.391 |
| Outside Ibadan (> 200 km)                      | 20 (21.5) | 73 (78.5) | 1 |  |
| **Relationship of FDR with Proband**           |     |    |             |   |
| Offspring                                      | 164 (41.3) | 233 (58.7) | 2.815 (0.312-25.419) | 0.357 |
| Siblings                                       | 53 (33.5) | 105 (66.5) | 2.019 (0.220-18.517) | 0.534 |
| Parents                                        | 1 (20.0) | 4 (80.0) | 1 |  |
| **Sex of Proband**                            |     |    |             |   |
| Male                                          | 125 (39.8) | 189 (60.2) | 1 |  |
| Female                                        | 93 (37.8) | 153 (62.2) | 0.919 (0.652-1.295) | 0.629 |
| **Educational status of Proband**              |     |    |             |   |
| Nil/Primary                                   | 26 (26.3) | 73 (73.7) | 1 |  |
| Secondary/Tertiary                            | 192 (41.6) | 269 (58.4) | 2.004 (1.235-3.253) | 0.005 |
| **Marital status of Proband**                 |     |    |             |   |
| Currently married                             | 188 (39.3) | 290 (60.7) | 1.124 (0.692-1.824) | 0.638 |
| Previously married                            | 30 (36.6) | 52 (63.4) | 1 |  |
| **Place of residence of Proband**             |     |    |             |   |
| Within Ibadan                                  | 203 (40.7) | 296 (59.3) | 2.105 (1.143-3.876) | 0.017 |
| Outside Ibadan                                 | 15 (24.6) | 46 (75.4) | 1 |  |
| **Age of Proband (y)**                        |     |    |             |   |
| <45                                           | 5 (55.6) | 4 (44.4) | 2.642 (1.269-5.505) | 0.009 |
| 45-65                                         | 108 (46.8) | 123 (53.2) | 1.864 (0.861-4.038) | 0.114 |
| Above 65                                      | 105 (32.8) | 215 (67.2) | 1 |  |
| **Duration of diagnosis in Proband (y)**       |     |    |             |   |
| ≤5                                            | 124 (40.0) | 186 (60.0) | 1 |  |
| >5                                            | 94 (37.6) | 156 (62.4) | 0.904 (0.642-1.273) | 0.563 |
| **Treatment of Proband**                      |     |    |             |   |
| Medical                                       | 167 (39.6) | 255 (60.4) | 1 |  |
| Both medical and surgical                     | 51 (37.0) | 87 (63.0) | 0.946 (0.776-1.154) | 0.584 |
| **Presenting VA in worse eye of Proband**     |     |    |             |   |
| Normal/mild VI                                | 112 (40.1) | 167 (59.9) | 1 |  |
| Moderate/severe VI                            | 24 (42.1) | 33 (57.9) | 1.084 (0.609-1.932) | 0.783 |
| Blind                                         | 82 (36.6) | 142 (63.4) | 0.861 (0.599-1.237) | 0.418 |
| **Presenting VA in better eye of Proband**    |     |    |             |   |
| Normal/mild VI                                | 165 (37.1) | 280 (62.9) | 1 |  |
| Moderate/severe VI                            | 40 (49.4) | 41 (50.6) | 1.656 (1.028-2.665) | 0.038 |
| Blind                                         | 13 (38.2) | 21 (61.8) | 1.051 (0.512-2.154) | 0.893 |

Bold values indicate statistically significant.

CI indicates confidence interval; FDR, first degree relative; OR, odds ratio; VA, visual acuity; VI, visual impairment.
expected that a history of surgery in the proband would prompt the FDR to present for examination considering the significance of such an event on the family.

There was significant association between the educational status of the proband and the uptake of screening by their FDR, with a higher presentation noted in the more educated. This may suggest that the FDRs of probands with a higher educational status are also likely to be well-educated and more likely to present. It could also be that probands with a higher educational status may be better able to influence their FDRs to present. Over 3-quarters (76.1%) of pre-senting FDRs had tertiary education. The positive link with a higher educational status may be better able to influence their FDR, with a higher presentation noted in the more educated group. This is a hospital-based study and the results may apply to glaucoma probands who present to the hospital in Nigeria and other similar sociocultural regions within SSA. We recommend direct contact with relatives through phone calls, possibly by a trained and dedicated counselor. In addition, walk-in screening services for FDRs and other high-risk population groups should be set up in multiple locations to improve access and provide affordable (possibly free) and prompt glaucoma screening services on a daily basis, including weekends.

There was a need to continue to evaluate strategies that would ensure that high-risk populations are examined early for glaucoma so that the scourge of blindness from the disease could be reduced. One of these strategies might very well be direct contact with the FDRs. A registration of the blind from glaucoma could make access to high-risk FDRs easier. A limitation of the study was that some FDRs in the intervention group could not be reached on phone likely because of inactive or wrong phone numbers. This could be resolved by verifying phone numbers at the point of collection by calling them. The use of focus group discussions and in-depth interviews would also be helpful in eliciting more information from the respondents.

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A third of the presenting FDRs had minor ocular complaints (mostly itching and difficulty reading small print) which may have prompted their presentation. However, it is also possible that they just used the opportunity of having presented to an eye clinic primarily for screening to make other complaints. Munachonga et al\textsuperscript{15} reported a similar finding.

In conclusion, we demonstrated a much better screening uptake than previous similar studies in developing countries by the use of direct phone calls of the FDRs. The use of invitation letters alone also provided a reasonable uptake of screening by the FDRs. Long distance and being busy at work were highlighted as the main reasons for nonuptake. We did not have this type of information prior the study. The result of this study will be very relevant in conducting a cost effectiveness study which may be relevant in determining the number of blind years prevented by the incremental proportion of screened glaucoma patients using direct phone calls of FDR compared with the cost of such services. It would also aid planning of glaucoma screening services in similar settings.

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This is a hospital-based study and the results may apply to glaucoma probands who present to the hospital in Nigeria and other similar sociocultural regions within SSA. We recommend direct contact with relatives through phone calls, possibly by a trained and dedicated counselor. In addition, walk-in screening services for FDRs and other high-risk population groups should be set up in multiple locations to improve access and provide affordable (possibly free) and prompt glaucoma screening services on a daily basis, including weekends.

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### Table 5. Multivariate Analysis Showing Predictors of FDR Visits Among Study Respondents

| Study Group | Odds Ratio | Lower | Upper | P     |
|-------------|------------|-------|-------|-------|
| Phone call  | 2.506      | 1.695 | 3.706 | <0.001* |
| No phone call | 1          |       |       |       |
| Age of FDR (y) |            |       |       |       |
| <45         | 3.593      | 1.613 | 8.007 | 0.002* |
| 45-65       | 2.790      | 1.199 | 6.493 | 0.017* |
| Above 65    | 1          |       |       |       |
| Place of residence of FDR |            |       |       |       |
| Within Ibadan | 5.200      | 2.860 | 9.456 | <0.001* |
| Outside Ibadan | 1.626      | 0.862 | 3.069 | |}

*Bold values indicate statistically significant. CI indicates confidence interval; FDR, first degree relative; VA, visual acuity; VI, visual impairment.
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