Published in final edited form as:

Am J Ophthalmol. 2013 August ; 156(2): 362–369. doi:10.1016/j.ajo.2013.03.005.

The Association Between Compliance with Recommended Follow-up and Glaucomatous Disease Severity in a County Hospital Population

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Abstract

Purpose—To assess the association between insufficient follow-up and clinical parameters such as disease severity and medication use among glaucoma patients at a metropolitan county hospital.

Design—Cross-sectional study

Methods—Two-hundred and six patients with established glaucoma were recruited from San Francisco General Hospital. Subjects were classified based upon compliance with recommended follow-up examination intervals over the year preceding commencement of the study as determined by patient medical records. Glaucoma severity was determined based upon the American Academy of Ophthalmology Preferred Practice Patterns guidelines. Multivariate logistic regression analysis was used to assess the relationship between adherence with follow-up visits and disease severity.

Results—After adjustment for the impact of potential confounding variables, subjects with severe glaucomatous disease were found to have been less adherent to their recommended follow-up than those patients with mild or moderate glaucomatous disease (adjusted OR 1.89, 95% CI 1.21–2.94; $P = .01$). Subjects who were on glaucoma medications were found to be less adherent to follow-up recommendations (adjusted OR 3.29, 95% CI 1.41–7.65, $P = .01$).

Conclusion—Subjects with poor follow-up adherence were significantly more likely to have severe glaucomatous disease suggesting that poor follow-up may contribute to disease worsening or, alternatively, those with more severe disease are less inclined to follow up at appropriate intervals.

Introduction

Glaucoma is one of the leading causes of blindness worldwide.¹ It is estimated that the number of individuals with open-angle glaucoma in the United States will increase by 50% such that 3.36 million adults will have the disease by the year 2020.² Multiple clinical trials have demonstrated that pharmacologic lowering of intraocular pressure reduces the rate of vision loss in glaucoma patients.^{3,4} Based upon these results, one may postulate that

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improved patient adherence with glaucoma therapy can significantly delay disease progression and vision loss.

Regular patient follow-up is critical for physicians to monitor glaucomatous disease and adjust therapy as needed.⁵ The American Academy of Ophthalmology recommends at least 2 follow-up visits per year in patients with primary open-angle glaucoma in the Preferred Practice Pattern guidelines.⁶ Lee *et al* found that lack of formal education, no use of prescribed glaucoma medications or belief that follow-up is less important if one uses glaucoma medications were all independent predictors of inconsistent glaucoma follow-up.⁷ Other questionnaire-based studies have identified reasons for poor follow-up adherence such as long waiting times,⁸ unfamiliarity with necessary treatment duration and lack of knowledge regarding the permanency of glaucoma-induced vision loss.⁹

While non-adherence to follow-up recommendations has been found to be directly associated with many risk factors, no adequately powered study has examined the association between follow-up adherence and clinical parameters such as glaucoma severity and medication use.

We conducted a cross-sectional study of individuals with glaucoma to determine if disease severity and use of glaucoma medications were factors associated with follow-up visit adherence at the San Francisco General Hospital (SFGH).

Methods

This cross-sectional study enrolled 206 glaucoma patients attending follow-up visits at the San Francisco General Hospital (SFGH) Glaucoma Clinic in San Francisco, California between June 1, 2011 and August 1, 2011. The clinic is located in a hospital that is administered by the county of San Francisco and serves the indigent and underinsured residents of the city of San Francisco. Human subjects approval for this study was obtained from the institutional review boards of the following organizations: SFGH; the University of California, San Francisco; and the Stanford University School of Medicine. Informed written consent was obtained from all participants. Health Insurance Portability and Accountability Act (HIPAA)-compliant consent forms were obtained from all study subjects. The research protocol adhered to the tenets of the Declaration of Helsinki for clinical research.

At SFGH, glaucoma patients are scheduled to attend routine follow-up visits at regular intervals based on disease severity (Table 1). Classification according to these guidelines was based on appointment data gathered from medical records. The electronic medical record revealed all appointment activity whether attended, canceled or missed. Rescheduled appointments were removed from the record. Only attended appointments were used in our analysis of follow-up adherence. Only approximately 5% of appointments are rescheduled within the department of ophthalmology at SFGH. Patients who did not attend follow-up within 1 month after their scheduled follow-up date were considered to have failed to attend a follow-up visit. We enrolled 83 and 123 subjects with good and poor follow-up, respectively.

All subjects were glaucoma patients treated at SFGH for at least 1 year prior to enrollment. Eligibility criteria included (1) an International Classification of Diseases (ICD-9) diagnosis of primary open-angle glaucoma (POAG), primary angle-closure glaucoma, exfoliative glaucoma, low-tension glaucoma or glaucoma suspect for more than one year; (2) an age of 40 years or older; and (3) the existence of medical record documentation regarding the dates of all glaucoma follow-up visits scheduled and attended over the past 12 months. Baseline

demographic factors, comorbidities, history of glaucoma surgery (i.e., trabeculectomy) and pharmacy data were retrieved from the patients' medical records.

The chief of the SFGH Glaucoma Service (SL) classified each study subject into one of three categories of disease severity: mild, moderate or severe. Patients considered to have "mild" glaucoma were those who had at least one eye with (1) a structural abnormality of the optic disc or retinal nerve fiber layer consistent with glaucoma (focal notching of optic disc rim, thinning of the neuroretinal rim with increased cupping of the disc, neuroretinal rim or peripapillary retinal nerve fiber layer hemorrhages) and (2) a normal Humphrey visual field examination (i.e., not meeting the criteria for a glaucoma defect as defined below). "Moderate" glaucoma was defined by (1) optic nerve abnormalities consistent with glaucoma as detailed above and (2) the presence of a glaucomatous visual field defect that did not cross the horizontal meridian and was not within 5 degrees of fixation. A glaucomatous visual field defect was considered present when a reliable Humphrey visual field test demonstrated 3 or more abnormal non-edge contiguous points not crossing the horizontal meridian, with a probability of <5% based upon comparison with age-matched non-glaucomatous individuals in the pattern deviation plot. Reliable visual fields were those with fixation loss, false-negative, and false-positive values of 33% or less.⁹⁻¹¹ If a visual field was unreliable, the subject then completed testing during study enrollment to achieve a reliable field. A patient was considered to have "severe" glaucoma if either eye had (1) optic nerve abnormalities consistent with glaucoma as detailed above and (2) visual field abnormalities in both hemifields and/or loss within 5 degrees of fixation in at least one hemifield in the worse eye or (3) visual acuity so severely diminished by glaucoma that HVF testing could not be performed (in this latter case, the cup-to-disc ratio was required to be 0.9 or greater).⁶ Subjects were required to have at least one reliable HVF in both eyes unless they were unable to complete this test due to severe disease. In circumstances when both eyes of the same patient were eligible for the study, the eye with the worse visual field mean deviation was selected. Patients for whom a diagnosis of glaucoma was made, but chart review revealed normal optic nerves and visual fields, did not meet entrance criteria and were excluded from the study.

Medication adherence was assessed using pharmacy data to ascertain the frequency of filled prescriptions and the number of days for which each prescription was filled or refilled. HIPAA-compliant consent forms, which had been obtained from study subjects, were faxed to all pharmacies from which glaucoma medications had been acquired based upon information noted in subjects' medical records. Individuals receiving free medication samples were excluded. However since it is the policy of the SFGH Medical Center to not provide free samples, none of the recruited subjects had received free samples. Pharmacy dispensing records were traced from the date of the interview to 18 months prior to the recruitment date.

Medication adherence was estimated using the medication possession ratio (MPR) for the 1-year period prior to the subject recruitment date. MPR was calculated as the sum of days of prescription supply dispensed divided by 365 days for each medication used, as calculated in previous studies.¹² Only medications initially prescribed at least one year prior to the recruitment date were included in the calculations for the final MPR measure. Patients were classified as "non-adherent" based on a MPR < 0.80 and "adherent" based on a MPR > 0.80, consistent with the dichotomization of medication adherence in the literature.^{13,14}

Baseline demographic factors and comorbidities were compared between follow-up adherent and non-adherent patients using the chi-square test for categorical variables and the students' t-test for continuous variables. Multivariate logistic regression models were used to assess the adjusted association between disease severity and follow-up adherence. These models

were adjusted for demographic characteristics (age, gender, race, education level) and clinical features such as the number of years since the initial diagnosis of glaucoma. According to Table 1, mild patients were required to have at least 2 visits to be adherent and moderate and severe patients were required to have at least 3 visits to be adherent. The different number of expected follow-up visits was included as a variable and was adjusted for in our multivariate analysis. Effect modification was tested using the Mantel and Haenszel summary odds ratio from stratified tables.

All comparisons were presented as odds ratios with 95% confidence intervals. *P* values of less than .05 using two-sided tests were deemed to represent a statistically significant association. All statistical analyses were conducted using IBM SPSS Statistics statistical software, version 19.0 (SPSS Inc, Chicago, Illinois).

Results

All 226 subjects found to be eligible for the study were offered enrollment, of which 15 chose not to participate on initial contact and another 5 decided to withdraw during the interview. Two hundred and six subjects were enrolled, including 123 classified as having poor follow-up and 83 with good follow-up based upon the Preferred Practice Pattern (PPP) guidelines (Table 1).

Table 2 presents demographic characteristics of adherent and non-adherent subjects. The mean age of the study population was 62 years and approximately 60% of subjects were women. Of the subjects classified as having good adherence, 10 (12.0%) were White, 11 (13.3%) were Black, 26 (31.3%) were Latino and 36 (43.4%) were Asian. A majority of the patients were not employed and had some form of government-sponsored health insurance. Of all variables included in the analysis, only disease severity was found to be independently associated with follow-up adherence. Subjects with severe glaucomatous disease were more likely to have been non-adherent with follow-up recommendations relative to those with mild disease (OR 2.68, 95% CI 1.43–5.02, *P* = .002).

Of the 206 subjects enrolled in the study, 157 used topical ocular medications to treat glaucoma. Table 3 compares the clinical characteristics of these subjects classified based upon medication adherence. Approximately 50% of patients were diagnosed with POAG and more than 75% were prescribed prostaglandin analog medications. Forty-five percent of patients received their glaucoma medications for free from insurance coverage. None of our patients received free samples as it is against hospital policy. Patients who were taking three medications were significantly more likely to be non-adherent to their medications compared to those taking only one medication (OR 2.90, 95% CI 1.08–7.72, *P* = 0.04). Out-of-pocket cost of medications and the total number of drops per eye per day were not found to be associated with medication adherence.

Logistic regression analysis predicting poor follow-up adherence is shown in Table 4. The variables in the multivariable analysis include age, gender, race, education, years of having glaucoma, history of glaucoma surgery, glaucoma medication use and disease severity (Table 2). As there were equal numbers of adherent and non-adherent subjects in the group that included subjects with either mild or moderate glaucomatous disease, defect severity was recoded into a dichotomous variable (mild or moderate vs. severe) for the multivariate analysis. The merging of groups with mild or moderate glaucoma severity did not alter the association between disease severity and follow-up adherence. More severe disease remained associated with poor follow-up (adjusted OR 1.89, 95% CI 1.21–2.94; *P* = .01). Subjects who had poor follow-up were more likely to be on IOP-lowering medications than those with good follow-up (adjusted OR 3.29, 95% CI 1.41–7.65, *P* = .01).

To examine whether or not the use of eyedrops was an effect modifier for the association between disease severity and follow-up adherence, we stratified for follow-up adherence and non-adherence by the use of glaucoma medications and disease severity. Patients who had a glaucoma procedure and did not require medications were excluded from analysis. Among the 49 patients who were excluded and did not receive glaucoma medications during the study period, nine patients had a glaucoma procedure, five of whom were classified as having severe glaucoma and four with mild/moderate glaucoma. The association between severe glaucomatous disease and poor follow-up was significant among those using glaucoma medications, but not significant among those who did not use IOP-lowering agents during the study: OR 4.11 (1.93–8.77), $P = 0.001$, and OR 2.78 (0.30 to 26.04), $P = 0.65$, respectively. The Mantel and Haenszel summary odds ratio of 3.92 differed from the adjusted OR of 2.94 confirming that the use of glaucoma medications modified the association between disease severity and follow-up adherence. The association between medication adherence and follow-up adherence was also examined, but this difference was not statistically significant (OR 1.41, 95% CI 0.75–2.66, $P = 0.33$).

Discussion

Inconsistent adherence to recommended follow-up intervals hinders the ability of the physician to track glaucoma disease progression, potentially increasing the likelihood of adverse disease outcomes.⁸ Although there has been much interest in the study of glaucoma medication adherence as a risk factor for vision loss, little attention has been given to follow-up visit adherence as a factor influencing the course of disease. Compliance with follow-up visit recommendations is a large public health problem for many chronic diseases that require regular monitoring.^{15–17} There is evidence to suggest that earlier glaucoma detection and treatment with IOP lowering medications can slow disease progression.¹⁸ Such treatment can only occur, of course, if patients are seen at prescribed intervals.

This study demonstrated, after adjustment for putative confounding variables, that more severe glaucomatous disease and being on IOP-lowering medications were factors associated with poor follow-up visit adherence in a county hospital population. A prior study examined the risk factors associated with inconsistent follow-up adherence at SFGH and found that black race, Latino ethnicity, unfamiliarity with necessary treatment duration and lack of knowledge of the permanency of glaucoma-induced vision loss were predictors of poor follow-up.⁹ The present study is unique in that it permits an examination of a large sample size and allows assessment of the importance of clinical characteristics such as disease severity and use of IOP-lowering medications as factors possibly impacting follow up.

Sleath and colleagues recently showed that more severe disease is associated with poor medication compliance in a private practice setting.¹⁹ No prior study, however, has examined the relationship between disease severity and follow-up adherence in an underserved population. This is the first study to show that more severe disease is associated with poor adherence to follow-up recommendations. Although causality between non-adherence to follow-up and glaucoma severity cannot be established in such a cross sectional analysis, this study provides the first evidence suggesting that patient adherence to follow up care may impact glaucoma severity. While it can be postulated that poor follow-up may contribute to disease worsening, perhaps by decreasing the opportunities for physician intervention when the disease is progressing, a prospective study to assess such possible causality is needed.

Use of prescribed glaucoma medications predicted poor follow-up after adjustment for confounding variables. These results contrast those of Kosoko *et al*, which showed that

patients with poor follow-up were less likely than patients with good follow-up to be taking glaucoma medications. There may be several reasons for these disparate results including a difference in how medication use was measured. Kosoko et al's study identified eyedrop use through self-report while we confirmed use of medications through prescription refill data. Because disease severity and the use of glaucoma medications were both significantly associated with follow-up adherence in the adjusted analysis, we performed a series of analyses to determine whether or not there was a difference in the effect of disease severity on follow-up adherence among those taking medications and those not taking medications. The association between disease severity and poor follow-up adherence was found to be significant only among those subjects using glaucoma medications. The differences in the Mantel-Haenszel summary odds ratio from the adjusted OR suggested that the use of glaucoma medications was an effect modifier. One limitation of this analysis was that 72% of our subjects were classified as using glaucoma medications, which led to unequal sample sizes in the two subgroups. A greater number of subjects in the subgroup comprised of those not taking glaucoma medications may have increased the likelihood of finding a statistically significant difference, if such a difference existed.

Our study showed that the majority of subjects receiving IOP-lowering medications demonstrated poor follow-up adherence. A possible explanation for these findings includes the false perception that the use of IOP-lowering medications ensures adequate glaucoma therapy obviating the need for regular physician follow up. This hypothesis is supported by one study, which found that there was an increased perception that it is not important to attend all follow-up visits if adhering to the prescribed medication regimen and noticing no vision change.⁹ It is noteworthy, however, that improper administration technique and poor adherence can reduce the efficacy of medication use. A study in Canada showed that 40% of patients demonstrated improper technique with 10% missing the eye completely.²⁰ Even if medications are administered properly and in a timely manner, there are no assurances that therapy that is effective at one time will continue to be effective in the future. Thus it is crucial for patients to attend follow up so that physicians are able to monitor disease progression and appropriately advance therapy, both medically and, if needed, with laser and surgical therapy, to minimize the likelihood of disease progression. Several studies have emphasized the importance of the use of IOP-lowering medications to delay vision loss in glaucoma patients,²¹ but our study suggests that perhaps seeing a physician regularly can also influence the prognosis of glaucoma patients.

Given our results, interventions aimed at improving follow-up with resultant closer monitoring of glaucomatous disease have the potential to slow progression. A prior study by Friedman *et al.* demonstrated that phone call reminders led to better medication adherence.²² At SFGH, phone call reminders for appointments are not standard practice and patients receive reminder cards when they make their appointment. Future studies to assess whether phone call reminders improve follow up adherence in glaucoma patients may be warranted.

This study has several limitations including those that relate to sample size, which may have impacted the power to detect existing differences between treatment groups that have already been mentioned. In addition, longitudinal data were unavailable to assess whether or not subjects with poor follow-up had progressively worsening disease relative to those with good follow-up. Data regarding patient's glaucoma severity at diagnosis was also unavailable. Future longitudinal studies should compare patients' initial glaucoma severity and follow-up adherence against these same qualities several months or years after diagnosis. A cross-sectional study such as ours is useful in assessing disease associations, but cannot establish causation. Another limitation is that the study did not account for patients who deliberately rescheduled appointments. When a patient rescheduled, the newly scheduled appointment was used for assessment of follow up adherence. It is possible that

those who rescheduled their appointments are more or less likely to follow up. We were not able to assess this aspect; however, only approximately 5% of patients at SFGH reschedule their appointments.

In summary, we found that more severe glaucomatous disease and whether the patient was on glaucoma medications were factors associated with poor follow-up visit adherence in a county hospital population. Our findings can help guide future studies, including large prospective trials, to further address this apparent and important dichotomous relationship. Although there has been a growing emphasis on the importance of medication adherence, follow-up adherence may be another important variable in determining disease progression. The findings from this study highlight the importance of understanding clinical characteristics associated with poor follow-up adherence such as disease severity and the use of medications. Providers are encouraged to educate patients regarding the importance of follow-up adherence to prevent the risk of future undetected and irreversible vision loss.

Acknowledgments

This study was supported by funding provided by Research to Prevent Blindness, New York, NY; That Man May See, Inc, San Francisco, CA and Stanford NIH/NCCR CTSA grant number TLI RR025742. Shan Lin has the following disclosures: Allergan: consultant; Merck: consultant. Kuldev Singh has the following disclosures: Alcon: consultant; Allergan: consultant. Involved in design and conduct of the study (C.U., Y.M., E.Z.); collection of data (C.U., E.Z., T.A., M.Z.); management (S.L., K.S., Y.M.), analysis (C.U.), and interpretation of the data (C.U., K.S., S.L.); and preparation, review, and approval of the manuscript (C.U., K.S., S.L.).

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Table 1

Criteria for Evaluating Adherence with Recommended Follow-Up Visits for Glaucoma Patients in a County Hospital Population. These were general guidelines for the study cohort, though each patient was reviewed individually based on recommended and actual follow-up patterns when assigning follow-up status.

	Glaucoma Disease Severity		
	Mild	Moderate	Severe
Follow-up recommendations ¹	Every 5–6 months (approximately 2 visits/year)	Every 4–5 months (approximately 3 visits/year)	Every 3–4 months (approximately 4 visits/year)
Good follow-up	2 visits, with 5–6 month maximum intervals between visits	3 visits, with 4–5 month maximum intervals between visits	3 visits, with 3–4 month maximum intervals between visits
Poor follow-up	1 visit or extended interval between visits	2 visits or extended interval between visits	2 visits or extended intervals between visits

¹ Glaucoma disease severity was evaluated based on the American Academy of Ophthalmology Preferred Practice Patterns guidelines for primary open-angle glaucoma (POAG) and POAG suspects. Mild: Characteristic optic nerve abnormalities are consistent with glaucoma, but the visual field is normal. Moderate: Visual field abnormalities exist in one hemifield and are not within central 5 degrees of fixation. Severe: Visual field abnormalities exist in both hemifields or visual field loss is within central 5 degrees of fixation.

Table 2

Baseline Characteristics of Glaucoma Patients (n = 206) in a County Hospital Population, by Adherence to Follow-Up Recommendations

Characteristic	Follow-Up Adherent Individuals (n=83)	Follow-Up Non-Adherent Individuals (n=123)	Unadjusted OR for Poor Follow-Up Adherence (95% CI)	P value
Age, mean (SD)	62.2 (9.7)	62.4 (9.4)		0.90
Gender				
Female	46 (55.4)	78 (63.4)	1 [Reference]	NA
Male	37 (44.6)	45 (36.6)	0.72 (.41–1.27)	0.25
Race/Ethnicity				
White	10 (12.0)	14 (11.4)	1 [Reference]	NA
Black	11 (13.3)	30 (24.4)	1.95 (0.67–5.66)	0.28
Latino	26 (31.3)	36 (29.3)	0.99 (0.38–2.57)	1.00
Asian	36 (43.4)	43 (35.0)	0.85 (0.34–2.15)	0.82
Education Level ^a				
Low	30 (36.1)	42 (34.1)	1 [Reference]	NA
Medium	27 (32.5)	38 (30.9)	1.00 (0.51–1.99)	0.99
High	26 (31.3)	43 (35.0)	1.18 (0.60–2.32)	0.63
Disease Severity				
Mild	42 (50.6)	42 (34.1)	1 [Reference]	NA
Moderate	16 (19.2)	14 (11.4)	0.88 (0.38–2.02)	0.75
Severe	25 (30.1)	67 (54.5)	2.68 (1.43–5.02)	0.002
Years with a glaucoma diagnosis, mean (SD)	5.44 (5.5)	6.12 (6.20)		0.42
Glaucoma surgical history				
Laser surgery treatment	13 (15.7)	20 (16.3)	1 [Reference]	NA
No interventional treatment	70 (84.3)	103 (83.7)	0.96 (0.45–2.05)	0.91
Glaucoma medications				
No	16 (19.2)	33 (26.8)	1 [Reference]	NA
Yes	67 (80.7)	90 (73.2)	1.54 (0.78–3.02)	0.21
Employment Status				
Employed	24 (28.9)	44 (35.8)	1 [Reference]	NA
Not working/retired/unemployed/laid off	59 (71.1)	79 (64.2)	0.73 (0.40–1.33)	0.31
Health insurance status				
Government coverage (Medicare, MediCal, SF Health Plan)	82 (98.8)	117 (95.1)	1 [Reference]	NA
Private	1 (1.2)	4 (3.3)	2.80 (0.31–25.54)	0.36
No Insurance	0 (0)	2 (1.6)	1.13E +09	1.0

Characteristic	Follow-Up Adherent Individuals (n=83)	Follow-Up Non-Adherent Individuals (n=123)	Unadjusted OR for Poor Follow-Up Adherence (95% CI)	P value
Size of Household, mean (SD), y				
Single	23 (27.7)	37 (30.1)	1 [Reference]	NA
Two	33 (39.8)	31 (25.2)	0.58 (0.29–1.19)	0.14
Three or more	24 (28.9)	49 (39.8)	1.27 (0.62–2.59)	0.51
Did not answer	3 (3.6)	6 (4.9)	1.24 (0.28–5.46)	0.77
Comorbid Conditions				
Diabetes (yes vs. no)	36 (43.3)	52 (42.3)	0.96 (0.55–1.68)	0.88
Hypertension (yes vs. no)	50 (60.2)	71 (57.7)	0.90 (0.51–1.59)	0.72
Arthritis (yes vs. no)	22 (26.5)	27 (22.0)	0.78 (0.41–1.49)	0.45
Cardiovascular Disease (yes vs. no)	18 (21.7)	16 (13.0)	0.54 (0.26–1.13)	0.10
Asthma (yes vs. no)	5 (6.0)	8 (6.5)	1.09 (0.34–3.44)	0.89
Hypercholesteremia (yes vs. no)	33 (39.8)	56 (45.5)	1.27 (0.72–2.23)	0.41

CI = confidence interval

OR = odds ratio

SD = standard deviation

^aLow: no formal education beyond primary school; medium: secondary school education or equivalent certification; high: undergraduate university or community college coursework

Table 3

Clinical Characteristics of Glaucoma Patients Using Glaucoma Medications (n = 157) in a County Hospital Population, by Medication Adherence

Characteristic	Medication Adherent Individuals (n=72)	Medication Non-Adherent Individuals (n=85)	Unadjusted OR for Poor Medication Adherence (95% CI)	P value
Years with a glaucoma diagnosis, mean (SD)	6.17 (5.38)	6.52 (6.91)		0.72
Number of glaucoma medications, mean (SD)	2.29 (1.33)	2.04 (1.22)		0.22
One	25 (34.7)	32 (37.6)	1 [Reference]	NA
Two	19 (26.4)	14 (16.5)	0.58 (0.24–1.36)	0.27
Three	7 (9.7)	26 (30.6)	2.90 (1.08–7.72)	0.04
Four or more	21 (29.2)	13 (15.3)	0.48 (0.20–1.15)	0.13
Number of drops per eye per day				
1 to 2 drops	23 (31.9)	25 (29.4)	1 [Reference]	NA
3 to 4 drops	10 (13.9)	8 (9.4)	0.74 (0.25–2.18)	0.78
5 to 9 drops	20 (27.8)	21 (24.7)	0.97 (0.42–2.22)	1.00
10 or greater drops	19 (27.1)	31 (36.5)	1.50 (0.67–3.35)	0.41
Monthly out-of-pocket cost of medications (dollars)				
0	25 (34.7)	45 (52.9)	1 [Reference]	NA
0.01 to 5	22 (30.6)	20 (23.5)	0.51 (0.23–1.10)	0.11
5.01 to 10	6 (8.3)	3 (3.5)	0.28 (0.06–1.20)	0.14
10.01 to 15	3 (4.2)	2 (2.4)	0.37 (0.06–2.37)	0.36
15 or greater	16 (22.2)	15 (17.6)	0.52 (0.22–1.22)	0.19
Drug Therapeutic Category				
Prostaglandins (yes vs. no)	51 (80.9)	48 (76.2)	0.85 (0.44–1.63)	0.62
Alpha-Agonists (yes vs. no)	22 (34.9)	24 (38.1)	1.15 (0.56–2.37)	0.71
CAI (yes vs. no)	22 (34.9)	21 (33.3)	0.88 (0.43–1.78)	0.72
Beta Blockers (yes vs. no)	45 (71.4)	42 (66.7)	0.80 (0.38–1.71)	0.56
Combination (yes vs. no)	1 (1.6)	1 (1.6)	1.0 (0.06–16.35)	1.00

CI = confidence interval

OR = odds ratio

SD = standard deviation

CAI= carbonic anhydrase inhibitor

Table 4

Multivariable Logistic Regression Analysis of Factors for Poor Follow-Up Adherence in Glaucoma Patients (n = 206) in a County Hospital Population

Variable	Unadjusted OR	P value	Adjusted OR	P value
Age (per year)	1.00 (0.97–1.03)	0.90	1.00 (0.96–1.03)	0.81
Gender (male vs. female)	0.72 (0.41–1.27)	0.25	0.60 (0.32–1.12)	0.11
Race (Asian vs. non-Asian)	0.70 (0.40–1.24)	0.22	0.78 (0.41–1.47)	0.46
Education (high school or more vs. less)	1.09 (0.61–1.96)	0.77	1.10 (0.58–2.08)	0.68
Years of having glaucoma (per year)	1.02 (0.97–1.07)	0.42	1.03 (0.97–1.09)	0.36
Glaucoma surgery (yes vs. no)	1.05 (0.49–2.24)	0.91	0.73 (0.30–1.74)	0.39
Medications (yes vs. no)	1.54 (0.78–3.02)	0.21	3.29 (1.41–7.65)	0.01
Disease severity (severe vs. mild/moderate)	2.78 (1.54–5.00)	0.001	1.89 (1.21–2.94)	0.01
Expected number of follow-up visits (mild: 2 visits; moderate and severe: 3 visits)	1.98 (1.12–3.49)	0.04	1.55 (0.60–3.98)	0.37

OR = odds ratio