

Patient Characteristics Are Associated with Appointment “No-Show” at a Tertiary Academic Glaucoma Service: A Cross-Sectional Study

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Keywords

Glaucoma · No-show · Area deprivation index · Loss to follow-up · Appointment nonattendance

Abstract

Introduction: Appointment “no-shows” (NS) are a significant issue for glaucoma patients, potentially leading to loss to follow-up, disease progression, and irreversible vision loss. This study investigates sociodemographic and clinical risk factors associated with NS at a tertiary academic eye center.

Methods: A retrospective review of 100 glaucoma patients at the University of Pittsburgh Medical Center (UPMC) Vision Institute over 1 year was conducted. Patients were categorized as NS if they missed any glaucoma service appointment and as never no-show (NNS) if no appointments were missed. Baseline demographic, medical, and ophthalmic data were collected. Socioeconomic disadvantage was measured using the area deprivation index (ADI) based on residential ZIP codes. **Results:** Of 100 patients, 35 were classified as NS and 65 as NNS. NS patients had significantly higher ADI scores (79 vs. 65; $p = 0.03$) and were more frequently Black (54% [19/35] vs. 26% [17/65]; $p = 0.01$). Medical comorbidities were more common in NS patients (83% [29/35] vs. 48% [31/65]; $p < 0.001$), as were mental health diagnoses (34% [12/35] vs. 8% [5/65]; $p < 0.001$). Insurance type, glaucoma type, intraocular pressure, and visual acuity

were not significantly different between groups.

Conclusion: Higher socioeconomic disadvantage, Black race, medical comorbidities, and mental health diagnoses were associated with appointment NS among glaucoma patients. These findings highlight the need for targeted interventions to address these risk factors, improve follow-up adherence, and reduce the risk of disease progression.

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Introduction

Chronic eye diseases such as glaucoma require regular follow-up appointments to monitor treatment response and to mitigate disease progression [1]. Unfortunately, many patients with glaucoma become lost to follow-up (LTFU), which puts them at risk of undertreatment and irreversible vision loss. For instance, an analysis of glaucoma patients in a nationwide ophthalmic registry demonstrated that half of glaucoma patients became LTFU over the 6-year study period, with LTFU defined as exceeding a year without an encounter [2, 3]. Similarly, a 10-year study of glaucoma patients at a single, academic institution found that a third of the cohort became LTFU by the end of the study period [4]. Concerningly, severe-stage disease and visual impairment are risk factors for

LTFU, indicating that the most vulnerable glaucoma patients are the ones at highest risk of being lost from care [2]. In fact, two-thirds of glaucoma patients who returned after a significant lapse in care in one study did so with disease progression or a late surgical complication [4].

LTFU is often preceded by an appointment “no-show” (NS), or nonattendance of a scheduled follow-up visit without cancellation or notification [5]. Glaucoma patients with NS can be reengaged through telephone outreach to assess barriers to care and to reestablish follow-up care [5–7]. Therefore, predicting which glaucoma patients are at risk of NS may allow for targeted interventions to dedicate resources toward a population at high risk of becoming lost from care. While some previous work has identified sociodemographic factors associated with NS in academic ophthalmology settings [8], little is known about clinical characteristics associated with NS among glaucoma patients. This study aims to identify clinical and sociodemographic risk factors for appointment NS among glaucoma patients at our tertiary academic eye center.

Methods

A cohort of 100 glaucoma patients with a scheduled return visit with the glaucoma service at University of Pittsburgh Medical Center (UPMC) Vision Institute in January 2021 was assessed using our electronic health record (EHR; Epic Systems). Scheduled visits on the glaucoma service over the calendar year 2021 were examined, and attendance of each appointment over the year was documented. Appointments were classified as attended, cancelled, or no-showed as documented in the EHR. If any appointment was no-showed over the course of the year for a given patient, then that patient was categorized as NS; patients without a NS visit over the 12-month study period were categorized as never no-show (NNS).

Demographic and clinical characteristics were collected and compared between the two groups from their clinical records. Demographic characteristics were collected included age, sex, race, place of residence, and insurance type. Clinical characteristics included best-corrected visual acuity (BCVA), intraocular pressure (IOP), type and severity of glaucoma as documented by the treating physician, number of glaucoma-specific medications, presence of medical comorbidities including hypertension, diabetes as other medical diagnoses, and presence of mental health diagnoses available in their EHR. Area deprivation index (ADI), a measure of so-

cioeconomic disadvantage, was determined by inputting residential ZIP code from the medical record into a national database [9]. NS patients were considered to be LTFU if their last NS visit was not followed by an attended appointment over the calendar year 2021.

Continuous data were assessed for normality and reported as medians (25th, 75th percentiles), while categorical data were presented as $N(\%)$. Statistical analyses were performed using the chi-squared test or Fisher's exact test for categorical variables and the Mann-Whitney test for continuous variables. A multivariable log-robust Poisson regression model was employed to estimate the relative risk (RR) and 95% confidence intervals (CIs) for NSs associated with baseline demographics. Confounders were selected based on the results of the univariate analysis. Analyses were performed using R (version 4.4.1). All tests were two-sided and a $p < 0.05$ was considered statistically significant.

Results

In our sample of 100 glaucoma patients, 51 were male, 61 were White, the median age was 69 years, and half (56) had private insurance. Half of the study cohort (54%) had severe-stage glaucoma, and the most common type was primary open-angle glaucoma. The median number of glaucoma medications was 2.0, median initial BCVA was 20/30 (logarithm of the minimum angle of resolution [logMAR] = 0.2), and median IOP was 15 mm Hg (Table 1).

Among 100 glaucoma patients with a scheduled return visit in January 2021, 35 had at least 1 NS visit over the calendar year while 65 patients were classified as NNS. Among the 35 NS patients, 15 did not return for another appointment in the 2021 calendar year and were thus classified as LTFU (Fig. 1). NS patients had more scheduled appointments, with a mean of 7.5 ± 5.5 appointments over the 12-month period compared to 5.4 ± 3.8 for NNS patients ($p = 0.0229$). Among the 35 NS patients, there were a total of 187 return visits scheduled, 21 procedure visits, and 56 postoperative appointments. NNS patients had 249 return visits, 41 procedure appointments, and 57 postoperative appointments. The proportion of cancelled visits was similar between the two groups; among NS patients, 27 appointments were cancelled compared to 32 for the NNS group ($p = 0.657$). Among the 264 total scheduled visits for the NS group, 47 appointments were missed, including 36 return visits, one procedure visit, and 10 postoperative appointments. Among NS patients, most had 1 NS visit over the study

Table 1. Demographic and clinical characteristics of 100 glaucoma patients by NS status

Variable	All patients (n = 100)	NS status		p value ^a
		NS (n = 35)	NNS (n = 65)	
Age, median [25th–75th percentile], years	69 [61.0, 77.0]	66 [60.5, 72.5]	72 [62.0, 78.0]	0.05
Gender, N (%)				
Female	49 (49.0)	18 (51.4)	31 (47.7)	0.88
Male	51 (51.0)	17 (49.6)	34 (52.3)	
Race/ethnicity, N (%)				
Black	36 (36.0)	19 (54.3)	17 (26.2)	0.01^c
White	61 (61.0)	15 (42.9)	46 (70.8)	
Other ^b	3 (3.0)	1 (2.9)	2 (3.1)	
Insurance type, N (%)				
Public	44 (44.0)	18 (51.4)	26 (40.0)	0.38
Private ^d	56 (56.0)	17 (49.6)	39 (60.0)	
Area deprivation index, median [25th–75th percentile]				
State decile	7.0 [4.0, 9.0]	8.0 [5.5, 9.0]	6.0 [2.0, 8.0]	0.02
National percentile	72.0 [46.5, 89.0]	79.0 [61.0, 91.0]	65.0 [35.0, 83.0]	0.03
Glaucoma type, N (%)				
POAG	62 (62.0)	20 (57.1)	42 (64.6)	0.15
Secondary glaucoma	21 (21.0)	7 (20.0)	14 (21.5)	
CACG	3 (3.0)	2 (5.7)	1 (1.5)	
Normal tension glaucoma	7 (7.0)	1 (2.9)	6 (9.2)	
Neovascular glaucoma	5 (5.0)	4 (11.4)	1 (1.5)	
Congenital or juvenile glaucoma	2 (2.0)	1 (2.9)	1 (1.5)	
Glaucoma severity, N (%)				
Mild	18 (18.0)	4 (11.4)	14 (21.5)	0.29
Moderate	22 (22.0)	8 (22.9)	14 (21.5)	
Severe	54 (54.0)	19 (54.3)	35 (53.8)	
Indeterminate	6 (6.0)	4 (11.4)	2 (3.1)	
Number of ocular medications, median [25th–75th percentile]	2.0 [1.0, 3.0]	2.0 [1.0, 3.0]	2.0 [1.0, 3.0]	0.41
Number of ocular comorbidities, median [25th–75th percentile]	3.0 [2.0, 4.0]	3.0 [2.0, 4.0]	3.0 [1.0, 4.0]	0.66
Medical comorbidities, N (%)				
Diabetes or hypertension	60 (60.0)	29 (82.9)	31 (47.7)	< 0.01^e
Diabetes	24 (24.0)	14 (40.0)	10 (15.3)	
Hypertension	55 (55.0)	25 (71.4)	30 (46.2)	
Mental health diagnosis, N (%)	17 (17.0)	12 (34.3)	5 (7.7)	< 0.01
Visual acuity, median [25th–75th percentile], logMAR	0.2 [0.0, 0.4]	0.2 [0.1, 0.6]	0.2 [0.0, 0.3]	0.10
IOP, median [25th–75th percentile], mm Hg	15.0 [11.0, 18.3]	16.0 [12.0, 18.0]	15.0 [11.0, 19.0]	0.75

CACG, chronic angle-closure glaucoma; IOP, intraocular pressure; logMAR, logarithm of the minimum angle of resolution; mm Hg, millimeters of mercury; POAG, primary open-angle glaucoma; SD, standard deviation. ^aChi-squared test or Fisher's exact test was used for categorical variables, which was based on the whether the expected value is <5, and the Mann-Whitney test was used for continuous variables. ^bOther races included 2 Asian and 1 unspecified. ^cDue to low number of "Other" races, comparison was made between Black and White. ^dPrivate insurance also includes supplemented public plans. ^eChi-squared test was used to compare patients with "diabetes or hypertension" with patients who had neither diagnosis.

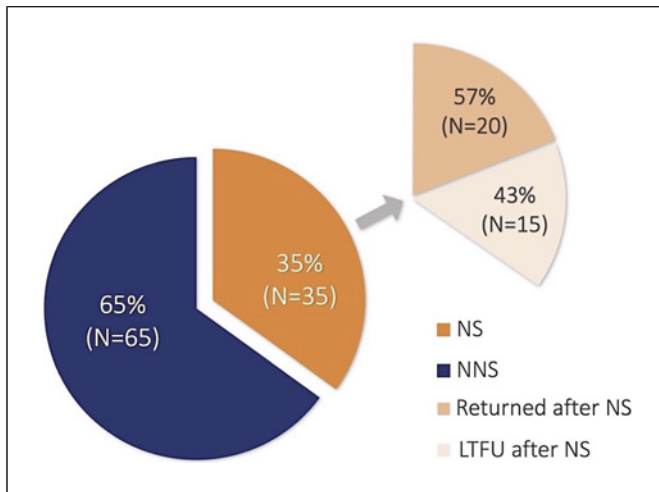


Fig. 1. Proportion of NS versus NNS in a cohort of 100 glaucoma patients.

period (80%), 4 patients had 2, one had 3, and two had 4 (Fig. 2).

Among demographic characteristics, Black race was significantly associated with appointment NS (54% of NS compared with 26% of NNS, $p = 0.01$) (Table 1). Additionally, a higher ADI was found in the NS group compared to the NNS group, both at the state decile (8.0 vs. 6.0, $p = 0.02$) and the national percentile (79 vs. 65, $p = 0.03$) (Table 1). Medical comorbidities, specifically diabetes, hypertension, and mental health diagnoses were significantly higher in the NS patient population than the NNS. In the NS group, 29 (83%) had a documented history of diabetes or hypertension compared to only 31 (48%) of the NNS group ($p < 0.01$) (Table 1). Similarly, NS patients also had a high burden of mental health diagnoses, with a documented psychiatric condition for 12 (34%) in the NS group compared to 5 (8%) of the NNS group ($p < 0.01$) (Table 1). In the NS group, these diagnoses included depression (4 patients), anxiety (2 patients), depression and anxiety (2 patients), schizotypal personality disorder (1 patient), bipolar disorder with anxiety (1 patient), and anorexia (1 patient). In the NNS group, depression (3 patients), depression and anxiety (1 patient), and bipolar disorder with schizophrenia (1 patient) were less common.

There was no significant difference between the two groups for age (median 66 years in NS, 72 years in NNS, $p = 0.05$), insurance type (publicly insured patients 51% in NS and 40% in NNS $p = 0.38$), or initial BCVA (mean logMAR 0.45 NS vs. 0.30 NNS, $p = 0.225$). Glaucoma type and severity were not associated with appointment NS,

with most patients diagnosed with primary open-angle glaucoma in both cohorts (57% in NS vs. 65% in NNS, $p = 0.119$) and severe-stage disease (54% in NS vs. 54% in NNS, $p = 0.266$) (Table 1). In a multivariable logistic regression, patients with a mental health diagnosis were twice as likely to miss appointments compared to patients without a mental health diagnosis (RR = 2.09, 95% CI: 1.23–3.53; $p \leq 0.01$) (Table 2).

Discussion

Our study retrospectively examined a cohort of 100 glaucoma patients over one calendar year and found that risk of appointment NS is significantly associated with medical comorbidities, mental health diagnoses, Black race, and socioeconomic disadvantage. Our reported NS rate of 35% is consistent with other studies of appointment attendance in US glaucoma patient populations, where NS rates ranged between 16.9% and 46% over variably defined time periods [8, 10].

Of the factors influencing attendance, higher comorbid disease burden demonstrated the most sizable bias toward the NS condition with 83% of NS patients having both diabetes and hypertension compared to only 48% of the NNS ($p < 0.001$). Medical comorbidities have previously been identified as a barrier to follow-up for glaucoma patients, perhaps due to poor mobility, appointment overlap, or unexpected hospitalizations [11]. Interestingly, mental health diagnoses were also significantly more prevalent among the NS cohort. A prior study examining appointment attendance in chronic eye disease demonstrated that mental illness was the only medical characteristic to predict NS [12], and mental health challenges have previously been identified as a barrier to healthcare [13]. Various reasons have been proposed to explain this association, including poor insight into one's own health among those with mental health challenges [14], and communication barriers leading to lower satisfaction with healthcare providers and the healthcare system [15]. Although efforts are underway to improve access to healthcare for this vulnerable population [16, 17], there is limited research on how ophthalmologists can provide care when mental health challenges present a barrier. Further research is needed on this topic, particularly given that visual impairment itself can increase the risk of developing depression or anxiety [18].

Black race was associated with higher risk of NS (54%) compared to NNS (26%), which is consistent with previous studies demonstrating that Black patients are more

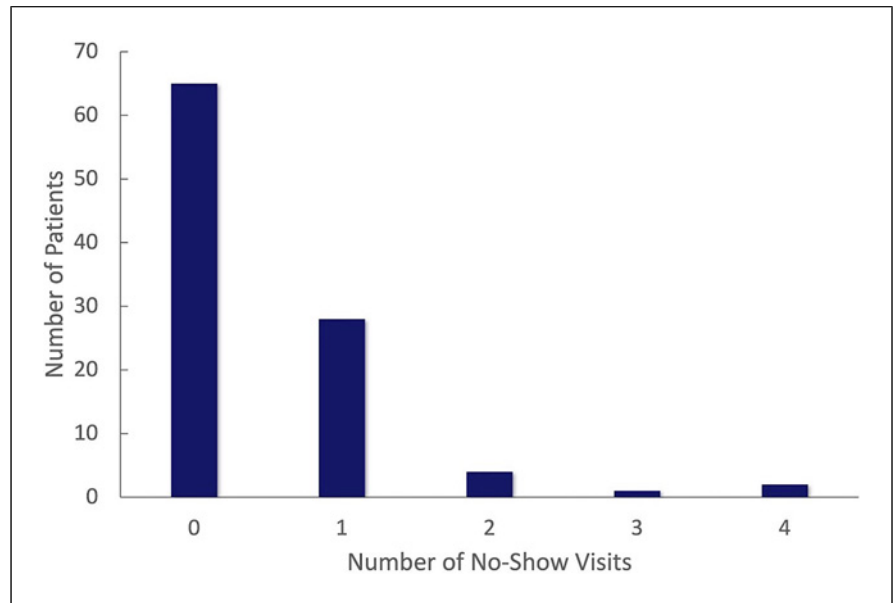


Fig. 2. Distribution of NS visits within a sample of 100 glaucoma patients over the 12-month study period.

Table 2. Multivariable associations between NS and baseline characteristics

Variables	RR (95% CI)	<i>p</i> value
Age		
<60 years	Ref.	
60–69 years	1.34 (0.7, 2.6)	0.38
70–79 years	1.02 (0.5, 2.09)	0.95
>80 years	0.38 (0.08, 1.83)	0.23
Race		
White	Ref.	
Black	1.46 (0.87, 2.45)	0.15
Others	1.8 (0.58, 5.6)	0.31
ADI (by state decile)	1.06 (0.94, 1.2)	0.34
Medical comorbidities		
No	Ref.	
Yes	1.77 (0.73, 4.33)	0.21
Mental health diagnosis		
No	Ref.	
Yes	2.09 (1.23, 3.53)	<0.01

ADI, area deprivation index; CI, confidence interval; Ref., reference; RR, relative risk.

likely to miss glaucoma appointments compared to patients of other races [12, 19–22]. This racial disparity may be due to several factors, including socioeconomic disadvantage, communication and cultural barriers, and distrust of the healthcare system [12]. Of note, Black patients are more likely to suffer from earlier and more

severe presentations of glaucoma [22], emphasizing the importance of improving appointment attendance rates and preventing LTFU among these patients. Systemic improvement in this sphere will improve vision health outcomes and overall quality of life in this disproportionately affected population.

Lower socioeconomic status is a known barrier to healthcare. A higher ADI corresponds to greater socioeconomic deprivation and is generally associated with worse healthcare outcomes [23]. In concordance with previous knowledge, we found that greater socioeconomic disadvantage, as measured by ADI, was associated with NS status at both state decile and national percentile. An association between low socioeconomic status and NS risk was similarly established in previous studies investigating appointment adherence in chronic eye disease [12] and referrals for diabetic retinopathy screening [24]. In glaucoma, higher levels of deprivation have been shown to be associated with worse severity at initial presentation [25]. Furthermore, our findings corroborate a previous large-scale cross-sectional study that identified that glaucoma patients with low income and lower levels of education were found to have lower rates of any interaction with an eye doctor [26]. Financial and social barriers which may contribute to inability to attend appointments include access to transportation, childcare, ability to take time off work, and varying levels of trust between patients and their medical providers.

A more integrated and holistic approach to glaucoma care can help connect patients at risk of NS to resources

that can help them maintain their appointments and reestablish care when necessary. One tool that has proven useful in our own practice is a patient navigator program, designed to connect patients in need with community resources [27]. In fact, our program was able to successfully address the referred need for 90% of referrals, highlighting the potential of this approach to improve access to eye care services [28]. As glaucoma-related vision loss may initially occur without any noticeable symptoms, identifying patients' barriers to care and referring to a patient navigator program may be an important step in promoting awareness and adherence to glaucoma care. A less resource-intensive option to engage with patients after NS is sending a standard EHR portal message after a missed appointment. In fact a single message sent through the EHR portal can double the odds of patient re-engagement with care within 30 days of the NS appointment [7]. A limitation of this study is that the glaucoma patient population within our academic medical center may not be representative of other populations, and further investigation into the risk of NS in various populations is needed.

Conclusions

Our research identified comorbid medical disease burden, mental health diagnosis, Black race, and greater socioeconomic disadvantage to be patient characteristics associated with a higher risk of NS in a glaucoma patient population. Revealing the factors that affect appointment attendance is an important initial step in overcoming barriers to care among glaucoma patients. Future research is needed to examine the prevalence of these risk factors in larger study populations across various clinical settings. In addition, the nature of the relationship between NS and certain clinical characteristics, including higher disease burden and mental health conditions, should be further evaluated, as the mechanisms by which they impact appointment attendance are still unclear. Understanding these risk factors will inform the design of more effective strategies to keep glaucoma patients adherent to regular care and improve vision outcomes.

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Statement of Ethics

This study was reviewed and approved by the Institutional Review Board (IRB) of the University of Pittsburgh, Approval No. (STUDY22040060). Informed consent was waived by the IRB. The procedures used in this study adhere to the tenets of the Declaration of Helsinki and comply with the Health Insurance Portability and Accountability Act of 1996.

Conflict of Interest Statement

The authors declare there is no potential conflict of interest.

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Author Contributions

S.R. analyzed and interpreted the patient data regarding the risk factors for appointment NS and was a major contributor in writing the manuscript. H-W.L. conducted statistical analysis. D.H., J.C., and L.M.W. were major contributors in writing the manuscript. A.M.W. oversaw the project and contributed to data analysis and manuscript revision. All authors read and approved the final manuscript.

Data Availability Statement

The datasets used and/or analyzed during the current study are not publicly available due to their containing information that could compromise the privacy of research participants. Data are available from the corresponding author upon reasonable request: Andrew M. Williams, MD williamsam14@upmc.edu. UPMC Vision Institute, 1622 Locust Street Office (412) 642-5389. Pittsburgh, PA 15213 Fax (412) 647-5119.

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