


BMJ Open Healthcare disparities contribute to missed follow-up visits after cataract surgery in the USA: results from the perioperative care for intraocular lens study

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ABSTRACT

Objective To identify factors that contribute to missed cataract surgery follow-up visits, with an emphasis on socioeconomic and demographic factors.

Methods In this retrospective cohort study, patients who underwent cataract extraction by phacoemulsification at Massachusetts Eye and Ear between 1 January and 31 December 2014 were reviewed. Second eye cases, remote and international patients, patients with foreign insurance and combined cataract cases were excluded.

Results A total of 1931 cases were reviewed and 1089 cases, corresponding to 3267 scheduled postoperative visits, were included. Of these visits, 157 (4.8%) were missed. Three (0.3%) postoperative day 1, 40 (3.7%) postoperative week 1 and 114 (10.5%) postoperative month 1 visits were missed. Age <30 years (adjusted OR (aOR)=8.2, 95% CI 1.9 to 35.2) and ≥90 years (aOR=5.7, 95% CI 2.0 to 15.6) compared with patients aged 70–79 years, estimated travel time of >2 hours (aOR=3.2, 95% CI 1.4 to 7.4), smokers (aOR=2.7, 95% CI 1.6 to 4.8) and complications identified up to the postoperative visit (aOR=1.4, 95% CI 1.0 to 2.1) predicted a higher rate of missed visits. Ocular comorbidities (aOR=0.7, 95% CI 0.5 to 1.0) and previous visit best-corrected visual acuity (BCVA) of 20/50–20/80 (aOR=0.4, 95% CI 0.3 to 0.7) and 20/90–20/200 (aOR=0.4, 95% CI 0.2 to 0.9), compared with BCVA at the previous visit of 20/40 or better, predicted a lower rate of missed visits. Gender, race/ethnicity, language, education, income, insurance, alcohol use and season of the year were not associated with missed visits.

Conclusions Medical factors and demographic characteristics, including patient age and distance from the hospital, are associated with missed follow-up visits in cataract surgery. Additional studies are needed to identify disparities in cataract postoperative care that are population-specific. This information can contribute to the implementation of policies and interventions for addressing them.

INTRODUCTION

Cataract extraction is the most commonly performed surgical procedure in the USA and the single largest expenditure of Medicare

Strengths and limitations of this study

- Variables that vary over time were assessed using a visit-based generalised estimated equation analysis.
- Data collection and recording were performed manually by trained research staff.
- Retrospective study design.
- Single-centre study.

surgical procedures, accounting for approximately three million cases performed annually.¹ The number of people with cataracts in the USA is forecasted to increase from the current estimation of approximately 25.7–45.6 million by 2050.¹

The month following cataract surgery is the time when most complications occur and when stable vision is achieved.² While the frequency of cataract surgery follow-up examinations varies, most patients are seen one to three times for planned postoperative evaluations to ensure the eye is healing, to assess compliance with postoperative instructions and medications, and to identify and treat complications if they arise.² Missed postoperative visits have been associated with higher risk of non-detection of complications and disease in outpatient eye care.^{3–5} While many cataract postoperative complications are symptomatic, certain postoperative sequelae, such as intraocular pressure elevation, can often go unnoticed and refractive errors can remain uncorrected unless the patient is evaluated.^{6–9} Moreover, missed visits result in underuse of clinical and administrative resources and lead to decreased clinical efficiency with potential concomitant revenue loss.^{10 11}

Reports have identified gender, racial and socioeconomic disparities in the use of eye care services.^{12–14} Understanding the disparities in care underlying missed postoperative visits is a first step in targeting interventions to increase follow-up compliance in these populations. However, studies estimating the rate and exploring the reasons of patient non-attendance following cataract surgery have been limited.

In a large series from India, Gupta *et al* investigated predictors of compliance with cataract surgery follow-up.¹⁵ However, that centre practised a follow-up pattern in which some patients were admitted to the hospital for 1–7 days, and socioeconomic factors were not studied. Two prior studies have small patient samples,^{16 17} included surgical cases performed by trainees only,^{16 17} evaluated non-attendance at a late (≥ 3 months) postoperative time-point¹⁶ or focused on an indigent, rural population.¹⁶ A comprehensive analysis of no-shows following cataract surgery in the USA is lacking.

In this study, we sought to identify demographic, socioeconomic and medical factors that predict missed cataract surgery follow-up visits in an academic practice in the USA, with an emphasis on identifying healthcare disparities.

METHODS

Study population

Patient data were extracted from the Perioperative Care for Intraocular Lens database, which incorporates perioperative data of patients who underwent cataract extraction by phacoemulsification at Massachusetts Eye and Ear between 1 January and 31 December 2014. All cases were performed by 10 comprehensive ophthalmologists. Cases for chart review were identified using Classification of Procedural Terminology codes 66982 (extracapsular cataract extraction with intraocular lens insertion, complex) and 66984 (extracapsular cataract extraction with intraocular lens insertion).

Missed visits

Cataract surgeons who participated in our study routinely schedule three postoperative visits for all patients, at day 1, week 1 and month 1 after surgery. A visit was considered 'missed' if the patient did not attend a scheduled postoperative day 1 (POD1) appointment within 2 days, postoperative week 1 (POW1) appointment between days 5 and 14, or postoperative month 1 (POM1) appointment between weeks 3 and 8 from surgery. If an emergency visit for any reason followed an unattended appointment within the aforementioned time intervals, the visit was considered 'attended'.

Automated phone calls 3 days prior to each appointment were delivered using the TeleVox electronic system (Mobile, Alabama, USA). No additional reminders were sent to patients who missed one or more follow-up visits.

Data

Review of the electronic medical records and data collection were conducted by four trained study personnel. We

evaluated variables that were found to be associated with missed visits in ophthalmology and other clinical settings and were thought to be relevant in cataract surgery.^{15–23}

Age, gender, race/ethnicity, primary language, level of education, insurance type, ocular comorbidities, season of the year and primary surgeon variables were categorised based on clinical relevance. Estimated travel time (ETT) to the location of the scheduled visit was determined using zip codes and the Google Maps web service set on a fixed date and time.²⁴ The driving module and the attending surgeon's practice location were selected for navigation. Average adjusted gross income by zip code was estimated after reviewing the 2014 income statistics published by the Internal Revenue Service.²⁵ For smoking and alcohol use, the definitions of the Centers for Disease Control and Prevention (CDC) National Health Interview Survey ('never smoker', 'current smoker' and 'former smoker')²⁶ and drinking patterns described by the National Institutes of Health ('no drinking', 'low-risk drinking' and 'high-risk drinking')²⁷ were adopted, respectively. If case categorisation was equivocal, values were assigned as missing.

Snellen best-corrected visual acuity (BCVA) measurements and complications were recorded for each encounter. In order to assess the association of visual outcomes with missed visits, we analysed BCVA at the previous visit, which represents the most recent recording prior to each appointment. Preoperative day 1 and week 1 BCVA recordings were used for POD1, POW1 and POM1 visits, respectively. For complications, we created a binary ('yes' or 'no') variable 'complications up to the prior visit', which indicates the occurrence of intraoperative and/or postoperative complications at a preceding postoperative visit. A patient was considered to have experienced an intraoperative complication if at least one of the following had occurred during surgery: posterior capsule tear, anterior capsule rent, zonular dehiscence, lens fragments dropped into the vitreous and placement of the intraocular lens into the anterior chamber or sulcus. A patient was defined as having a postoperative complication if at least one of the following was noted at a postoperative visit: intraocular pressure measurement above 21 mm Hg, anterior chamber paracentesis, displaced intraocular lens, wound leak, severe corneal oedema, epithelial defect or retained lens fragment.

Exclusion criteria

The following cases were excluded (1) second eye cases; (2) patients with a declared place of residence outside the broader area of Massachusetts, New Hampshire, Vermont, Maine, Rhode Island, Connecticut and New York, including international patients; (3) patients owning foreign insurance; (4) cataract cases combined with vitreoretinal or glaucoma surgery; and (5) former drinkers, due to the small number. A flowchart of selected cases is provided in [figure 1](#).

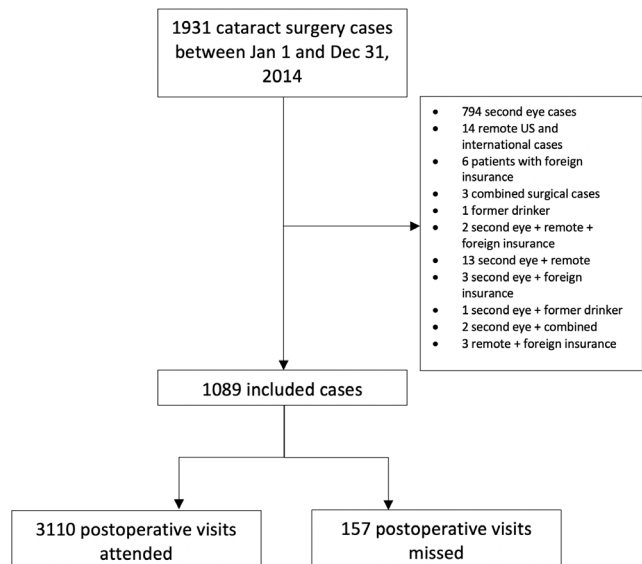


Figure 1 Flowchart of case selection and outcomes. Some cases were excluded for more than one reason.

Statistical analysis

Analyses were performed using STATA V.15. In order to assess time-varying and visit-specific variables, such as ‘BCVA at prior visit’, complications up to the prior visit and ‘season of the year for each visit’, we stratified patient clusters to single-visit observations. Unadjusted associations between predictors and the binary ‘missed visits’ outcome were estimated using generalised estimated equation (GEE) with an exchangeable correlation matrix while accounting for between-visit correlations. Variables associated with missed visits with a p value of <0.1 were entered in a multivariable GEE model in order to identify independent predictors for missed visits and to estimate the adjusted associations.

Missing data that were hypothesised to be associated with the outcome variable (eg, unreported data on race/ethnicity and education level) were analysed as an additional category. Values that were thought to be missing at random were deleted in a listwise fashion. The α level of significance was set at 0.05 and p values were two-sided.

RESULTS

Descriptive characteristics

Out of 1931 cataract cases reviewed, a total of 1089 cases were included (figure 1). The mean patient age was 63.5 years (SD 11.1 years). Four hundred and sixty-eight (43.0%) were men and the majority, 788 (72.4%), were white patients. One hundred and forty-one (12.9%) cases missed at least one postoperative visit: 128 (11.8%) patients did not attend one postoperative visit; 10 (0.9%) patients did not attend two postoperative visits; and 3 (0.3%) patients did not attend all three postoperative visits. Table 1 summarises the demographic and clinical characteristics of included cases.

Table 1 Demographic and clinical characteristics of cataract patients

	n (%) or mean±SD†
Age group (years)	63.5±11.1
Gender	
Male	468 (43.0)
Female	621 (57.0)
Missing	0 (0.0)
Race/ethnicity	
White	788 (72.4)
Black/African-American	91 (8.4)
Hispanic	42 (3.9)
Asian	54 (5.0)
Other/NR*	114 (10.5)
Primary language	
English	867 (79.6)
Other	102 (9.4)
Missing	120 (11.0)
Highest education level	
High school or lower	211 (19.4)
College or higher	372 (34.2)
NR*	506 (46.5)
Adjusted gross income	
<\$50 000	433 (39.8)
\$50 000–\$74 999	469 (43.1)
≥\$75 000	185 (17.0)
Missing	2 (0.2)
Insurance	
Commercial	649 (59.6)
Public	307 (28.2)
Commercial and public	109 (10.0)
Self-pay	20 (1.8)
Missing	4 (0.4)
Estimated travel time (min)	
≤120	1065 (97.8)
≥121	22 (2.0)
Missing	2 (0.2)
Smoking status	
Never smoker	889 (81.6)
Current smoker	67 (6.2)
Former smoker	131 (12.0)
Missing	2 (0.2)
Alcohol use	
No drinking	598 (54.9)
Low-risk drinking	443 (40.7)
High-risk drinking	46 (4.2)
Missing	2 (0.2)

Continued



Table 1 Continued

	n (%) or mean±SD†
Ocular comorbidities	
No	624 (57.3)
Yes	465 (42.7)
Missing	0 (0.0)
Primary surgeon	
Attending	799 (73.4)
Resident	283 (26.0)
Missing	7 (0.6)
Missed visits	
No	948 (87.1)
Yes	141 (12.9)
Missing	0 (0.0)

*Missing data in race/ethnicity and highest education level were analysed as a distinct category.

†Percentages may not add up to 100%.

NR, not reported.

Of the 3267 postoperative visits analysed, 3110 (95.2%) were attended and 157 (4.8%) were missed. Three (0.3% of POD1 visits) POD1, 40 (3.7% of POW1 visits) POW1 and 114 (10.5% of POM1 visits) POM1 visits were missed. Table 2 summarises the demographic and clinical characteristics of included cases at each visit by follow-up status.

Predictors

Groups that were significantly associated with missed visits in the bivariate analysis were patient age <30 years (unadjusted OR (uOR)=7.4, 95% CI 1.7 to 31.4) and ≥90 years (uOR=4.0, 95% CI 1.5 to 10.8) compared with patients aged 70–79 years, ETT of >2 hours (uOR=2.8, 95% CI 1.3 to 6.4), current smokers compared with those who had never smoked (uOR=2.5, 95% CI 1.5 to 4.2) and the occurrence of complications during surgery or at a previous postoperative visit (uOR=1.5, 95% CI 1.0 to 2.1). A history of ocular comorbidities (uOR=0.7, 95% CI 0.5 to 0.9) and patients with BCVA at the previous visit 20/50–20/80 (uOR=0.4, 95% CI 0.3 to 0.7) and 20/90–20/200 (uOR=0.4, 95% CI 0.2 to 0.9), compared with patients with prior-visit BCVA 20/40 or better, were associated with a lower rate of missed visits in the bivariate analysis. Gender, race/ethnicity, primary language, education level, adjusted gross income, insurance type, drinking status, season of the year and primary surgeon type were not associated with missed visits in the bivariate analysis. Table 2 shows the bivariate associations of candidate predictors with missed visits.

The aforementioned significantly associated variables were included in the multivariable analysis. Adjusted gross income was also modelled as the p value was less than 0.1 for the ≥\$75 000 category. Groups that were significantly associated with missed visits in the multivariable analysis were age <30 years (adjusted OR (aOR)=8.2,

95% CI 1.9 to 35.2) and ≥90 years (aOR=5.7, 95% CI 2.0 to 15.6) compared with patients aged 70–79 years, ETT of >2 hours (aOR=3.2, 95% CI 1.4 to 7.4), current smokers compared with those who had never smoked (aOR=2.7, 95% CI 1.6 to 4.8) and the occurrence of complications during surgery or at a previous postoperative visit (aOR=1.4, 95% CI 1.0 to 2.1). A history of ocular comorbidities (aOR=0.7, 95% CI 0.5 to 1.0) and patients with previous visit BCVA 20/50–20/80 (aOR=0.4, 95% CI 0.3 to 0.7) and 20/90–20/200 (aOR=0.4, 95% CI 0.2 to 0.9), compared with patients with BCVA at the previous visit 20/40 or better, were associated with a lower rate of missed visits in the multivariable analysis. Adjusted gross income did not independently predict the incidence of missed visits. Table 2 shows the multivariable analysis of missed visits predictors.

Figure 2 illustrates the joint effect of ETT and the postoperative visit timepoint. In our cohort, 0.3% of POD1, 3.4% of POW1 and 10.3% of POM1 visits were missed in patients who had to travel ≤2 hours to the clinic. For patients who had to travel >2 hours, none of POD1, 18.2% of POW1 and 18.2% of POM1 visits were missed. Figure 3 shows the joint effect of prior-visit BCVA, complications and ocular comorbidities. The percentage of missed visits decreased with worsening BCVA categories when controlling for both complications alone and complications in conjunction with ocular comorbidities. Patients with BCVA of 20/210 or worse demonstrated the highest risk for missed visits, and the pattern was maintained even when controlling for complications and ocular comorbidities.

DISCUSSION

This study explored risk factors for missed follow-up visits after cataract surgery in a US tertiary academic centre and identified demographic healthcare disparities that are associated with patient non-attendance, including patient age and distance from the clinic.

The no-show rate of postoperative visits in this study was lower than the reported rate in other studies, which commonly reaches over 20%.^{16 17 20 21 28 29} In our study, 4.8% of postoperative appointments were unattended and 12.8% of patients missed at least one follow-up visit. The improved compliance with scheduled postoperative care demonstrated in this study is likely multifactorial and can be attributed to the short driving distances and the public transportation in Boston, the increased medical awareness of the population as a whole, the reminder system used in our department, and the emphasis of our physicians and staff on the importance of follow-up attendance, especially on the first postoperative day. The no-show rate of patients who underwent cataract surgery in India (14.4%) was similar to that measured in this study, showing that factors pertaining to the geographical region and institution significantly affect patient behaviour.¹⁵

Table 2 GEE bivariate and multivariable analyses of potential predictors of missed follow-up visits after cataract surgery

	Total visits (n)	Missed visits, n (%)	Unadjusted OR (95% CI)	P value*	Adjusted OR (95% CI)	P value*
Age group (years)						
18–29	12	3 (25.0)	7.4 (1.7 to 31.4)	0.007†	8.2 (1.9 to 35.2)	0.005†
30–39	21	1 (4.8)	1.1 (0.1 to 9.9)	0.93	1.4 (0.2 to 12.1)	0.78
40–49	141	6 (4.3)	1.0 (0.4 to 2.5)	0.98	0.9 (0.4 to 2.3)	0.82
50–59	465	26 (5.6)	1.3 (0.8 to 2.2)	0.31	1.2 (0.7 to 2.0)	0.56
60–69	1071	45 (4.2)	1.0 (0.6 to 1.5)	0.91	0.9 (0.5 to 1.3)	0.49
70–79	1137	49 (4.3)	Ref		Ref	
80–89	381	21 (5.5)	1.3 (0.7 to 2.3)	0.37	1.4 (0.8 to 2.5)	0.24
≥90	39	6 (15.4)	4.0 (1.5 to 10.8)	0.006†	5.7 (2.0 to 15.6)	0.001†
Missing	0	0 (0.0)	–	–	–	–
Gender						
Male	1404	67 (4.8)	Ref			
Female	1863	90 (4.8)	1.0 (0.7 to 1.4)	0.94		
Missing	0 (0.0)	0 (0.0)	–	–		
Race/ethnicity						
White	2364	111 (4.7)	Ref			
Black/African–American	273	16 (5.9)	1.3 (0.7 to 2.3)	0.43		
Hispanic	126	6 (4.8)	1.0 (0.4 to 2.5)	0.97		
Asian	162	7 (4.3)	0.9 (0.4 to 2.1)	0.84		
Other/NR‡	342	17 (5.0)	1.1 (0.6 to 1.9)	0.83		
Primary language						
English	2601	125 (4.8)	Ref			
Other	306	15 (4.9)	1.0 (0.6 to 1.8)	0.95		
Missing	360	17 (4.7)	–	–		
Highest education level						
High school or lower	633	32 (5.1)	Ref			
College or higher	1116	44 (4.0)	0.8 (0.5 to 1.3)	0.3		
NR‡	1518	81 (5.3)	1.1 (0.7 to 1.7)	0.8		
Adjusted gross income						
<\$50 000	1299	71 (5.5)	Ref		Ref	
\$50 000–\$74 999	1407	68 (4.8)	0.9 (0.6 to 1.3)	0.54	0.9 (0.6 to 1.3)	0.57
≥\$75 000	555	18 (3.2)	0.6 (0.3 to 1.0§)	0.07	0.7 (0.4 to 1.2)	0.21
Missing	6	1 (16.7)	–	–	–	–
Insurance						
Commercial	1947	83 (4.3)	Ref			
Public	921	52 (5.7)	1.3 (0.9 to 2.0)	0.13		
Commercial and public	327	19 (5.8)	1.4 (0.8 to 2.4)	0.25		
Self-pay	60	3 (5.0)	1.2 (0.3 to 4.2)	0.8		
Missing	12	0 (0.0)	–	–		
Estimated travel time (min)						
≤120	3195	149 (4.7)	Ref		Ref	
≥121	66	8 (12.1)	2.8 (1.3 to 6.4)	0.012†	3.2 (1.4 to 7.4)	0.006†
Missing	6	0 (0.0)	–	–	–	–
Smoking status						

Continued

Table 2 Continued

	Total visits (n)	Missed visits, n (%)	Unadjusted OR (95% CI)	P value*	Adjusted OR (95% CI)	P value*
Never smoker	2676	119 (4.5)	Ref		Ref	
Current smoker	192	20 (10.4)	2.5 (1.5 to 4.2)	0.001†	2.7 (1.6 to 4.8)	0.0004†
Former smoker	393	18 (4.6)	1.0 (0.6 to 1.8)	0.91	1.1 (0.6 to 1.9)	0.71
Missing	6	0 (0.0)	–	–	–	–
Alcohol use						
No drinking	1794	84 (4.7)	Ref			
Low-risk drinking	1329	62 (4.7)	1.0 (0.7 to 1.4)	0.98		
High-risk drinking	138	11 (8.0)	1.8 (0.9 to 3.6)	0.11		
Missing	6	0 (0.0)	–	–	–	–
Ocular comorbidities						
No	1872	105 (5.6)	Ref		Ref	
Yes	1395	52 (3.7)	0.7 (0.5 to 0.9)	0.022†	0.7 (0.5-1.0¶)	0.05†
Missing	0	0 (0.0)	–	–	–	–
Complications up to prior encounter						
No	2519	112 (4.5)	Ref		Ref	
Yes	748	45 (6.0)	1.5 (1.0§ to 2.1)	0.026†	1.4 (1.0§ to 2.1)	0.05†
Missing	0	0 (0.0)	–	–	–	–
BCVA at prior encounter						
20/40 or better	1683	98 (5.8)	Ref		Ref	
20/50–20/80	973	27 (2.8)	0.4 (0.3 to 0.7)	<0.0001†	0.4 (0.3 to 0.7)	0.0003†
20/90–20/200	276	8 (2.9)	0.4 (0.2 to 0.9)	0.028†	0.4 (0.2 to 0.9)	0.026†
20/210 or worse	335	24 (7.2)	1.0 (0.6 to 1.6)	0.97	1.0 (0.6 to 1.7)	0.92
Missing	0	0 (0.0)	–	–	–	–
Season						
Winter	783	40 (5.1)	Ref			
Spring	874	39 (4.5)	0.9 (0.5 to 1.4)	0.57		
Summer	713	38 (5.3)	1.0 (0.6 to 1.7)	0.89		
Autumn	879	38 (4.3)	0.9 (0.5 to 1.4)	0.53		
Missing	18	2 (11.1)	–	–	–	–
Primary surgeon						
Attending	2397	109 (4.6)	Ref			
Resident	849	46 (5.4)	1.2 (0.8 to 1.8)	0.34		
Missing	21	2 (9.5)	–	–	–	–

*P value derived by bivariate or multivariable GEE analysis is testing whether there is a significant difference in the rate of missed visits for each candidate predictor category compared with the reference category.

†Statistically significant.

‡Missing data in race/ethnicity and highest education level were analysed as a distinct category.

§CI limit>1.0.

¶CI limit<1.0.

BCVA, best-corrected visual acuity; GEE, generalised estimated equation; NR, not reported; ref, reference.

The POM1 visit was the highest risk for non-attendance followed by the POW1 visit. This is consistent with other studies concluding that long lead time from scheduling to appointment increases the risk of missing a visit.^{20 23 30 31} Patients are less able to plan effectively long-term,¹⁶ and are more likely to forget or seek care elsewhere.³² Moreover,

as vision improves and complaints such as eye discomfort and redness are diminished, a postoperative visit is more likely to be perceived as unnecessary.³²

Gupta *et al* found a linear association of visual acuity and follow-up compliance, with patients having better visual outcomes demonstrating more adherence.¹⁵ On

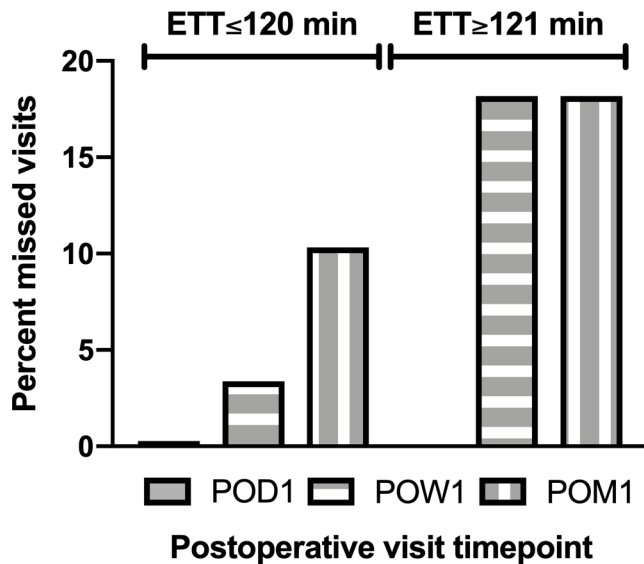


Figure 2 Percentage of missed follow-up visits at each postoperative timepoint after cataract surgery stratified by ETT category. ETT, estimated travel time; POD1, postoperative day 1; POM1, postoperative month 1; POW1, postoperative week 1.

the contrary, in our cohort, better visual acuity at the previous visit was associated with a higher rate of subsequent missed appointments, except for patients with very low vision who exhibited the highest rate of non-attendance, even after controlling for confounders. This difference may be explained by the fact that we specifically studied visual acuity at the most recent visit, while Gupta *et al* used preoperative/discharge visual acuity.¹⁵ Although we cannot explain this finding in our study with certainty, we hypothesise that the low-vision group represented frustrated patients who possibly sought care at another provider. Similarly, complicated cases were less adherent to follow-up in our study. This is in agreement with Gupta *et al*,¹⁵ again possibly indicating patient frustration and switch of healthcare provider.

Very young and very old patients demonstrated significantly higher risk for missed appointments, in accordance with other studies.^{10 21 22 33–39} Young patients may be more indifferent about their health or may find it difficult to take time off work and off family duties.^{22 39} Older patients are at greater risk for medical comorbidities, ambulatory difficulties and cognitive impairment, often making them dependent on a companion for medical visits.^{40 41} More than one-third of the US population aged 65 years and older report some type of disability, including walking problems and independent living difficulties.⁴² Barriers to healthcare for those individuals may also be practice-related. In a telephone survey, 22% of subspecialty practices in four US cities reported inability to accommodate patients with mobility impairment due to physical barriers and inaccessibility.⁴³

Given that multiple postoperative encounters are usually recommended after cataract surgery, distance to the clinic and accessibility of transportation may

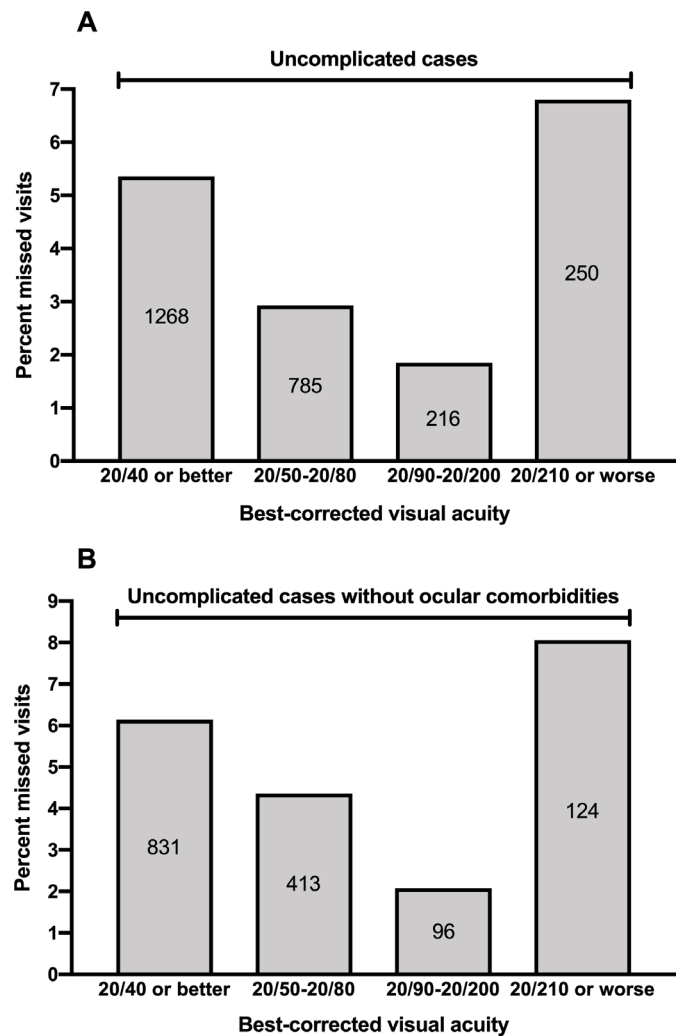


Figure 3 Percentage of missed follow-up visits of (A) uncomplicated cases and (B) uncomplicated cases without history of ocular comorbidities stratified by best-corrected visual acuity category.

significantly influence patient willingness and ability to show up.^{13 44} In our cohort, the likelihood of missed appointments increased with longer times required to get to the clinic. The difference was especially notable for patients who had to travel >2 hours compared with patients who needed a 2-hour trip or less. The former group was largely represented by patients living in nearby counties and the suburbs, for whom a trip to Boston may seem more time-consuming and logistically challenging. Other studies have shown that residents in rural areas are less likely to use eye care services compared with urban residents.⁴⁵ The CDC reported lower access to eye care in states with long travel distances, such as Missouri, New Mexico, Colorado and Indiana.⁴⁶ Orr *et al* found that having the ability to drive increased the odds of visiting an ophthalmologist compared with non-drivers.¹⁸ However, patients with vision problems are more likely to have discontinued driving, creating barriers to visiting the doctor's office, especially in areas with poor public transportation systems.⁴⁷

Although many studies have identified socioeconomic disparities in the use of eye care and the receipt of cataract surgery,^{13 19 21 33 48 49} factors such as race/ethnicity, language, income, insurance and education level did not predict missed visits in our cohort. In the study by Chou *et al* examining how socioeconomic indices affect access to eye examinations, Massachusetts demonstrated a higher rate of eye exams in Hispanics, less educated individuals and low-income people.¹⁹ These observations were attributed to the expansion of MassHealth, the combined state Medicaid programme, and the near-universal health coverage resulting from the 2006 Massachusetts health-care reform, which provided free or subsidised insurance to residents earning less than the federal poverty level.^{19,50} More studies are needed in order to clarify whether our observations are state-specific or apply to other regions as well.

Given the dynamic structure of healthcare systems and the variability of determinants for access, addressing disparities in healthcare can be a challenging task. The study of disparities in different areas of healthcare is fundamental for developing effective strategies at the public level. The implementation of access standards dictating the mandated travel time to the clinic, the time frame within which appointments must be scheduled and the minimum number of providers relative to the population have shown mixed results in primary and specialty care.⁵¹ However, policy implementation has been more effective in improving access and reducing inequalities.⁵¹ These policies need to be consistently updated and adjusted driven by state-specific needs.⁵² Also, with ongoing advances in teleophthalmology, telecommunication techniques, such as virtual encounters and the acquisition of ocular images, may be considered for cataract patients who are at high risk for non-attendance. This could include patients needing to travel >2 hours to the clinic, the very young and the elderly.⁵³

This study represents the first comprehensive documentation of factors that predict no-shows at cataract surgery follow-up in the USA and the first to investigate the effect of socioeconomic factors on cataract postoperative care. Furthermore, by performing a visit-based analysis, we were able to accurately assess the effect of visual acuity and complications, variables that are indirectly evaluated in other studies.

Limitations of the study are its retrospective design (retrospective data acquisition and missing data) and the fact that participants were recruited from a single institution. Thus, results may not be generalisable to centres with different follow-up patterns and geographical areas with disparate socioeconomic background and transportation systems. Although we recruited a substantial number of cataract cases, a larger sample size would allow for more accurate estimation of the odds of missed visits in unusual patients, such as the very young ones (wide CI may indicate a labile association), as well as further subgroup and joint-effect analyses. Lastly, patient financial status in our study was based on residential data; therefore, the risk of ecological fallacy cannot be ruled out.

In conclusion, this study identified factors that predict missed follow-up visits after cataract surgery in a tertiary US hospital. Studies in other regions will help to evaluate the rates and reasons for non-compliance at a national level. These results inform inequalities in cataract surgery postoperative care and provide a tool to cataract surgeons and health planners for identification of patients that are high risk for non-attendance, thereby forming a basis for more effective scheduling at the practice level. Targeted interventions have the potential to avoid interruptions in healthcare delivery and to ensure even receipt of cataract care at the community level.

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Data availability statement Data are available upon reasonable request. Raw data underlying the study cannot be made publicly available due to ethical

restrictions imposed by the Massachusetts Eye and Ear and Partners Healthcare Institutional Review Board (IRB). Upon request, deidentified data will be shared along with any information necessary to interpret the data, such as study protocols, data instruments and survey tools. Prior to that, the detailed plan to execute these methods must be reviewed and approved by the IRB, according to the Partners Healthcare policy. We will ensure long-term data storage and availability by consistently renewing our IRB protocol and by maintaining electronic files of the dataset in more than one encrypted computers/USB devices and in the Massachusetts Eye and Ear file hosting service. Researchers interested in the data may contact any of the authors as follows: Giannis Moustafa, Massachusetts Eye and Ear, telephone number: (617) 523-7900, email: giannis_moustafa@meei.harvard.edu; Durga Borkar, Wills Eye Hospital, telephone number: (215) 928-3000, email: durga_borkar@meei.harvard.edu; Emily Eton, Kellogg Eye Institute, telephone number: (734) 763-8122, email: emily.eton@gmail.com; Nicole Koulistis, USC Roski Eye Institute, telephone number: (323) 442-6335, email: nkoulisti@gmail.com; Carolyn Kloek, Dean McGee Eye Institute, telephone number: (405) 271-1090, email: Carolyn-Kloek@dmei.org.

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