Patterns of Care for Open-angle Glaucoma in Managed Care

Allen M. Fremont, MD, PhD; Paul P. Lee, MD, JD; Carol M. Mangione, MD, MSPH; Kanika Kapur, PhD; John L. Adams, PhD; Steven L. Wickstrom, MS; José J. Escarce, MD, PhD

Objectives: To describe patterns of care for primary open-angle glaucoma (POAG) and assess conformance with the American Academy of Ophthalmology’s Preferred Practice Pattern (PPP).

Methods: We obtained administrative, survey, and eye care records data on 395 working-age patients with POAG enrolled in 6 managed care plans between 1997 and 1999. We assessed processes of care at the initial and follow-up visits, control of intraocular pressure (IOP), intervals between visits and visual field tests, and adjustments in therapy.

Results: We found high rates of performance on most recommended processes during initial evaluations, although only 53% of patients received an optic nerve head photograph or drawing and only 1% had a target IOP level documented. Recommended processes were performed at 80% to 97% of follow-up visits. Using loose criteria for control, IOP was controlled in 66% of follow-up visits for patients with mild glaucoma and 52% of visits for patients with moderate to severe glaucoma. Intervals between visits and visual field tests were generally consistent with PPP recommendations. Adjustments in therapy were more likely with worse control of IOP, although adjustments occurred in only half of visits where the IOP was 30 mm Hg or higher.

Conclusions: Our study suggests that, in many respects, patients with POAG are receiving care that is consistent with the PPP. However, care is falling short on several key aspects, and POAG may be undertreated relative to standards for IOP control established in recent clinical trials.

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VARIATIONS in practice patterns and concerns about the quality of medical care have prompted the development of practice guidelines, along with interest in the extent to which actual practice is consistent with recommended care. Currently, the most widely accepted set of practice guidelines for primary open-angle glaucoma (POAG) is the American Academy of Ophthalmology’s Preferred Practice Pattern (PPP). However, relatively little is known about how actual care for POAG compares with the care suggested in the PPP.

Two prior studies have examined the conformance of patterns of glaucoma care with PPP recommendations. The first study examined patterns of care for patients with POAG treated between 1989 and 1992 in an academic public clinic in Los Angeles, Calif, that served as a referral center for glaucoma care. The researchers concluded that there was a high rate of conformance with recommended care for POAG, in contrast to results obtained in similar studies of corneal ulcers and diabetic retinopathy.

The second study replicated the first in 8 private community practices in the Los Angeles area and examined patterns of care for patients with POAG treated between 1989 and 1993. Although certain processes of care, such as measuring intraocular pressure (IOP) and performing a visual field test at the initial visit, were consistent with PPP recommendations, far fewer patients received other aspects of recommended care, such as a photograph or drawing of the optic nerve head. Additionally, although most patients with well-controlled glaucoma had intervals between follow-up visits that were consistent with PPP recommendations, fewer of those with unstable glaucoma were seen at the recommended intervals.

Although revealing, the data from these 2 studies were collected a decade ago in a single city. More recent studies have used data from registries of patients with POAG to describe patients’ utilization patterns or health care provider surveys to
assess treatment preferences for POAG. However, these studies did not assess conformance with PPP recommendations.

This study updates and extends prior research by describing current patterns of care for POAG. The patients in this study were working-age enrollees of 6 commercial managed care health plans located throughout the United States. They were treated in a wide variety of practice settings and received care between 1997 and 1999. We focus on processes of care emphasized in the 1996 version of the Academy of Ophthalmology’s PPP.

METHODS

SETTING

The 6 study health plans are independent practice association (IPA) model health maintenance organizations (HMOs) affiliated with a large managed care organization. One plan is located in the Northeast, 3 in the Midwest, 1 in the South, and 1 in the West. Each plan offers 2 commercial products: HMO and HMO-Plus. Enrollees in the HMO product are not required to identify a primary care physician or to obtain referrals for specialty care within the plan’s network, but they are not covered for out-of-network use. The HMO-Plus product offers out-of-network coverage subject to higher cost sharing than for in-network services. Both products include pharmacy benefits subject to cost sharing. Each study plan selectively contracts with ophthalmologists and optometrists in the community. Contracting eye care providers practice in every type of setting, including solo practices, small and large eye care groups, and multispecialty groups.

DATA SOURCES

The sources of data for the study were administrative data from the study plans, a patient survey, and eye care records.

Administrative Data

The study plans maintain several administrative data files. Enrollment files contained demographic and enrollment information for each plan enrollee, including age, sex, and dates of enrollment. Provider files contained information for each provider, including specialty and practice location. Claims files contained detailed information on all services provided to plan enrollees, including the provider of the service, the type of service, and the patient’s diagnoses. These data were used to identify office visits to eye care providers, consultations, visual field examinations and gonioscopies, and surgical procedures performed by eye care providers (ophthalmologists and optometrists).

Patient Survey

The patient survey contained modules on demographic characteristics, visual functioning, visual symptoms, the duration of POAG, and self-rated general health and generic health-related quality of life (HRQOL). Demographic characteristics included age, sex, race and ethnicity, and education. Visual functioning was measured using the National Eye Institute 25-item Visual Function Questionnaire (VFQ-25), which assesses patients’ perception of visual disability and limitations in the performance of visual activities. The VFQ-25 yields an overall visual function score that ranges from 0 (worst) to 100 (best). The module on visual symptoms asked patients whether they saw halos or rings around light, had blurry vision, had sore or tired eyes, had excessive tearing, had difficulty seeing in the dark, or experienced other symptoms typical of POAG. Respondents self-rated their general health as excellent, very good, good, fair, or poor, and generic HRQOL was assessed using the Medical Outcomes Study 12-Item Short-Form Health Survey (SF-12). The SF-12 yields summary measures of physical health (Physical Component Summary, or PCS) and mental health (Mental Component Summary, or MCS) that range from 0 to 100.

Eye Care Records

Eye care record abstraction forms were developed for this study by 2 of us (P.P.L. and C.M.M.). We used these forms to obtain information on processes of care, clinical findings, and treatments related to patients’ initial evaluation for POAG and every follow-up visit during the study period (see the “Study Period” subsection). Information on the initial evaluation included whether visual acuity, pupil, IOP, and slitlamp examinations were performed at the first visit for POAG to the patient’s main eye care practice (see the “Study Sample” subsection). It also included whether gonioscopy, evaluation of the optic disc and nerve fiber layer, a photograph or drawing of the optic nerve head, fundus evaluation, and a visual field test were performed at or up to 12 months before or 6 months after the first visit and whether a target IOP level was specified at the first visit.

Information for follow-up visits included whether an interval ocular history was documented and whether visual acuity, IOP, and slitlamp examinations were performed at or up to 1 week before or after each visit. The abstractors also documented all IOP readings and documented and photocopied all visual field examinations for later scoring by one of us (P.P.L.).

STUDY PERIOD

We obtained information on all services provided to study patients by eye care providers, including office visits, consultations, diagnostic tests, and surgical procedures, between April 1, 1997, and June 30, 1999, which we refer to as the study period. Because few initial evaluations for POAG took place during the study period, we additionally obtained information on initial evaluations between January 1, 1993, and March 31, 1997.

STUDY SAMPLE

We selected the study sample in 3 steps. First, we used administrative data to identify patients who were continuously enrolled in a study plan and had at least one claim for POAG from an ophthalmologist or optometrist between January 1, 1997, and June 30, 1998. We assigned each patient to a main eye care practice based on the ophthalmologists and optometrists responsible for the majority of the patient’s claims (69% of patients were treated in only one practice). We sampled practices using an algorithm that assigned higher probabilities of being sampled to practices with more patients and then sampled patients within practices using an algorithm that assigned a higher probability of being sampled to patients treated in practices with fewer patients. The initial sample consisted of 864 patients with POAG.

Second, we administered the patient survey by telephone between February and May 1999. Of the 864 patients, 52 were ineligible because they denied having POAG or because they had disenrolled from the study plan. Of the remaining 812 patients, 599 responded to the survey (74% response rate). Survey respondents and nonrespondents were similar in age and sex.
Third, we attempted to abstract eye care records for the 599 survey respondents between March and December 2000. Trained medical records abstractors visited all the eye care practices where these patients were treated and entered data on the abstraction forms. We successfully abstracted records for 395 patients (66% of survey respondents); the most common reasons for not abstracting records were lack of cooperation by eye care providers and inability to locate records. Survey respondents whose records were abstracted were similar to those whose records were not abstracted in sex, race and ethnicity, VFQ-25 score, self-rated general health, and PCS and MCS scores. Respondents whose records were abstracted were 2 years older than those whose records were not abstracted (mean age, 54.7 vs 52.6 years; P = .03).

The sample of patients for the study consisted of the 395 patients who responded to the patient survey and whose eye care records were abstracted. These patients were treated in 108 different main eye care practices. We abstracted the records for 100 initial evaluations that took place after January 1, 1995, and 2321 (87%) of 2673 follow-up visits and consultations that took place during the study period.

ANALYSIS

We assessed a variety of aspects of care emphasized in the PPP, including specific processes of care at initial evaluations and follow-up visits, control of IOP at follow-up visits, intervals between follow-up visits and between visual field tests, and adjustments in therapy. All visit and visual field test intervals that began or ended during the study period were included in the analysis.

For some analyses, we classified patients by the severity of glaucomatous damage. Eyes were defined as having mild damage if there were no or minimal visual field abnormalities or an arcuate-type scotoma in one hemifield only and as having moderate to severe damage if there was visual field loss inside the central 10° or any visual field loss in both the superior and inferior hemifields. When visual field test results were unavailable, we defined mild damage as a cup-disc ratio of 0.6 or less and moderate to severe damage as a cup-disc ratio of more than 0.6.5,6 We classified patients based on the more severely affected eye.

We used 2 different sets of criteria to classify follow-up visits according to the degree of control of IOP. Using strict criteria, we defined the IOP in eyes with mild damage as controlled if it was 19 mm Hg or less, borderline controlled if it was 20 or 21 mm Hg, and uncontrolled if it was 22 mm Hg or higher. We defined the IOP in eyes with moderate to severe damage as controlled if it was 16 mm Hg or less, borderline controlled if it was 17 or 18 mm Hg, and uncontrolled if it was 19 mm Hg or higher. Using loose criteria, we defined the IOP in eyes with mild damage as controlled if it was 21 mm Hg or less, borderline controlled if it was 22 or 23 mm Hg, and uncontrolled if it was 24 mm Hg or higher. We defined the IOP in eyes with moderate to severe damage as controlled if it was 18 mm Hg or less, borderline controlled if it was 19 or 20 mm Hg, and uncontrolled if it was 21 mm Hg or higher. Visits were classified based on the least well-controlled eye.

All analyses were weighted using inverse probability weights to account for differences across patients in the probability of being included in the study sample. Standard errors were corrected for clustering of follow-up visits within patients and patients within practices.16

RESULTS

PATIENT CHARACTERISTICS

Patients had a mean age of 54.7 years, were nearly equally divided between men and women, and were predominately white (Table 1). Self-rated general health, PCS and MCS scores, and the number of medical conditions indicated that patients were in relatively good health. The mean duration of glaucoma was almost 8 years, and the mean VFQ-25 score of 85.6 was similar to that in other glaucoma samples.13 Just more than half of patients had moderate to severe glaucomatous damage when the maximum severity in both eyes was considered.

INITIAL EVALUATION

Visual acuity, IOP, and slitlamp examinations; optic disc and nerve fiber layer evaluation; and fundus evaluation were performed in conjunction with 88% to 99% of initial evaluations for POAG (Table 2). Most patients also received a pupil examination (74.2%), visual field test (66.2%), and photograph or drawing of the optic nerve head (53.0%) during their initial evaluation. In contrast, fewer than half of patients had a gonioscopy during their initial evaluation.

Providers explicitly documented a target IOP level extremely rarely, ie, in only 1.3% of initial evaluations.

FOLLOW-UP VISITS

Visual acuity and IOP were checked in more than 95% of follow-up visits (Table 3). The interval ocular history was documented and a slitlamp examination was performed in more than four fifths of follow-up visits.

CONTROL OF IOP

The mean ± SD IOP across follow-up visits was 20.0 ± 4.7 mm Hg for patients with mild glaucomatous damage and

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<tr>
<th>Table 1. Patient Characteristics*</th>
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<tr>
<td>Characteristic</td>
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<tr>
<td>Age, y</td>
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<tr>
<td>Female, %</td>
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<tr>
<td>Nonwhite, %</td>
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<tr>
<td>Self-rated general health status excellent or very good, %</td>
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<tr>
<td>No. of medical conditions</td>
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<tr>
<td>PCS score</td>
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<tr>
<td>MCS score</td>
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<tr>
<td>Duration of glaucoma, y</td>
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<tr>
<td>No. of glaucoma symptoms</td>
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<tr>
<td>VFQ score</td>
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<tr>
<td>Glaucoma severity, %</td>
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<tr>
<td>Left eye</td>
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<td>Mild</td>
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<td>Moderate to severe</td>
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<td>Right eye</td>
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<td>Mild</td>
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<td>Moderate to severe</td>
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<tr>
<td>Maximum severity, both eyes</td>
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<tr>
<td>Mild</td>
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<td>Moderate to severe</td>
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Abbreviations: MCS, Mental Component Summary from the 12-item Short-Form Health Survey (SF-12)15; PCS, Physical Component Summary from the SF-12; VFQ, 25-item Visual Function Questionnaire.13
*Data are reported as mean ± SD unless otherwise indicated.
19.6±5.7 mm Hg for patients with moderate to severe damage (P = .13). Table 4 presents data on the degree of IOP control at follow-up visits. Using the strict criteria (see the “Methods” section), patients with mild damage had the IOP in both eyes controlled in just less than half of follow-up visits whereas patients with moderate to severe damage had the IOP in both eyes controlled in one third of visits (P = .001 for comparison of mild vs moderate to severe patients). Using the loose criteria, patients with mild damage had the IOP in both eyes controlled in nearly two thirds of follow-up visits compared with just more than half of visits for patients with moderate to severe damage (P = .002).

**INTERVALS BETWEEN FOLLOW-UP VISITS**

Irrespective of severity, more than three fourths of follow-up visits occurred within 6 months of the preceding one (Table 5). Nonetheless, intervals between visits were shorter for patients with moderate to severe damage than for patients with mild damage (P = .001). Less than 5% of all intervals between follow-up visits were longer than 12 months.

For patients with mild glaucomatous damage and with moderate to severe damage, intervals between follow-up evaluations became shorter with worsening control of IOP (P < .001). For example, one third of patients with mild damage whose IOP was uncontrolled had a follow-up visit within 1 month of the preceding visit compared with 8.6% of patients with mild damage whose IOP was controlled. Similarly, 36.8% of patients with moderate to severe damage whose IOP was uncontrolled returned for a follow-up visit within 1 month compared with 17.4% of such patients whose IOP was controlled.
INTERVALS BETWEEN VISUAL FIELD TESTS

Patients with moderate to severe glaucomatous damage had visual field tests at shorter intervals than did patients with mild damage ($P<.001$) (Table 6). Nonetheless, more than two fifths of intervals for patients with moderate to severe damage were longer than 12 months and 9% were longer than 24 months.

ADJUSTMENTS IN THERAPY

Four fifths of patients were receiving medical therapy for POAG at their first follow-up visit during the study period; nearly all were taking topical agents. An increase in medical therapy for POAG, defined as an increase in the dose of a glaucoma medication or the addition of a new medication, occurred at 13.7% of follow-up visits, including 13.6% of visits for patients with mild glaucomatous damage and 13.8% of visits for patients with moderate to severe damage. Compared with follow-up visits where the IOP was controlled, increases in medical therapy were twice as likely at visits where the IOP was borderline controlled and nearly 5 times as likely at visits where the IOP was uncontrolled ($P<.001$) (Table 7). Follow-up visit intervals after visits where there was no increase in medical therapy were shorter when the IOP was uncontrolled than when the IOP was controlled ($P<.001$).

Additional analyses found that the likelihood of an increase in medical therapy at a follow-up visit rose with increasing IOP ($P<.001$). Thus, an increase in medical therapy occurred at 44.6% of visits where the IOP was 26 to 29 mm Hg and at 49.3% of visits where the IOP was 30 mm Hg or higher. Surprisingly, the likelihood of an increase in medical therapy at visits where the IOP was uncontrolled was unassociated with the degree of IOP control during the 6 months preceding the visit.

A total of 9.5% of the study patients underwent at least 1 surgical procedure for POAG during the study period (data not shown), including 5.0% of patients with mild glaucomatous damage and 13.7% of patients with moderate to severe damage ($P<.001$). Laser trabeculoplasty was the most frequent procedure, closely followed by filtering procedures. Thus, of patients who had at least 1 surgical procedure, 58.3% underwent a laser trabeculoplasty, 43.1% underwent a filtering procedure, 7.5% underwent a shunting procedure, and 3.9% underwent cyclodestructive surgery. About 8.3% of visits where the IOP was uncontrolled were followed by a surgical procedure within 3 months compared with 3.0% of visits where the IOP was borderline controlled and 1.2% of visits where the IOP was controlled ($P<.001$).

Table 6. Visual Field Test Intervals by Severity of Glaucomatous Damage

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<tr>
<th>Interval Between Visual Field Tests, mo</th>
<th>Severity*</th>
<th>Value</th>
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<tr>
<td>≤3</td>
<td>2.9</td>
<td>4.0</td>
</tr>
<tr>
<td>3-6</td>
<td>4.7</td>
<td>13.1</td>
</tr>
<tr>
<td>6-12</td>
<td>30.5</td>
<td>39.5</td>
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<tr>
<td>12-24</td>
<td>48.2</td>
<td>34.9</td>
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<tr>
<td>&gt;24</td>
<td>13.7</td>
<td>8.6</td>
</tr>
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</table>

*Severity of glaucomatous damage is defined in the "Methods" section. Data are reported as the percentage of intervals between visual field tests.

most processes of care recommended during the initial evaluation for POAG and during follow-up visits. With few exceptions, intervals between visits were consistent with those suggested in the PPP.

Nonetheless, for certain key processes, patterns of care were not consistent with the PPP. For instance, nearly half the patients in the study did not have a photograph or drawing of the optic nerve head at the time of their initial evaluation. This is worrisome because of the importance of having a reproducible image at baseline for future comparison and to assess disease progression. Interestingly, an earlier study in private community practices found even lower rates of this care process, and a recent survey found that only four fifths of ophthalmologists reported obtaining a photograph or drawing as part of an initial glaucoma evaluation.

Another care process encouraged by the PPP, documenting a specific target IOP level, appeared to be largely ignored by eye care providers. This is problematic in that many of the recommendations for care in the PPP depend on whether the IOP is above or below the target. Although it is likely that most ophthalmologists and optometrists implicitly choose a target IOP level based on factors such as the severity of glaucoma and adverse effects of treatment, failure to explicitly document a target IOP level may lead to inconsistent care both over time and across providers.

The PPP does not indicate specific target IOPs; rather, it suggests general guidelines for choosing the target IOP level, including lower targets for patients with more severe damage. Therefore, we operationalized the concept of a target IOP level using 2 alternative criteria to assess control of IOP. Our loose criteria reflected a conservative approach to setting target pressure levels and were consistent with the IOP reduction goals used in the design of several recent clinical trials. Our strict criteria reflected a more aggressive approach to IOP control and were consistent with the findings of these trials and some earlier studies regarding the optimal IOP for preserving visual function.

As expected, we found that control of IOP was better when we used the loose rather than the strict criteria. However, we also found that the mean IOP level was similar for patients with mild damage and with moderate to severe damage, and that control of IOP was worse for patients with moderate to severe damage, irrespective of the criteria used. Further, IOP was uncontrolled in nearly half

COMMENT

This study updates and extends prior work by describing current patterns of care for POAG in managed care plans located in multiple regions throughout the United States. We found that, for many processes of care, practice patterns were consistent with those recommended in the American Academy of Ophthalmology's PPP. In particular, we found relatively high rates of performing
of follow-up visits for patients with moderate to severe damage even under the loose criteria. A possible explanation is that lower levels of IOP than we observed are difficult to achieve without adverse effects, although this seems unlikely. Alternatively, providers may not consistently choose lower target pressure levels for patients with more severe damage, as suggested by the PPP. Additional research is needed on the target IOP levels typically used by eye care providers to treat POAG and on how they vary with the severity of glaucomatous damage.

We found evidence that provider decision making regarding the time intervals between follow-up visits was influenced by both the severity of glaucomatous damage and the degree of IOP control, as suggested in the PPP; interval durations were consistent with the PPP. Very few visit intervals exceeded 12 months, the maximum interval duration suggested in the PPP, and four fifths of the intervals were 6 months or less.

On the other hand, although the time intervals between visual field tests depended on the severity of damage, as suggested in the PPP, the percentages of intervals longer than 12 months and longer than 24 months were surprisingly high, especially for patients with moderate to severe damage. The PPP suggests that visual field tests be performed yearly on all patients with POAG, except those with long-standing control of IOP and no progression of glaucomatous damage. Moreover, even for these highly stable patients, visual field tests should be performed at least every 2 years.

As expected, the probability of an increase in medical therapy for POAG at a follow-up visit was dependent on the degree of IOP control at the visit; eye care providers increased medical therapy much more often when the IOP was uncontrolled, by our criteria, than when it was controlled. However, the proportion of visits in which therapy was increased was surprisingly low; for example, an increase in medical therapy occurred in fewer than half of visits where the IOP exceeded 25 mm Hg, a level at which the risk of vision loss rises sharply. Also surprising, the likelihood of an increase in medical therapy was unaffected by the severity of glaucomatous damage. These findings, coupled with the findings for mean IOP level and IOP control, suggest that many eye care providers may be willing to accept elevated IOPs in their patients. A recent study documented a similar phenomenon in the treatment of hypertension by primary care physicians. Our study has several limitations. First, we did not assess patient compliance with eye care provider recommendations. For example, some of the long intervals between follow-up visits or visual field tests and the relatively low rates of IOP control may have been due to patients’ failure to follow providers’ instructions, not to provider decision making. Our study is best viewed as describing the care actually received by patients with POAG, but not necessarily the care recommended by eye care providers.

Second, we did not address the issue of misdiagnosis and resulting inappropriate treatment. However, because the average duration of glaucoma in our sample was nearly 8 years, most misdiagnoses are likely to have been corrected by the study period.

Third, we had no information on the eye care provided to the study patients before they enrolled in the study plans. A possible explanation for the low rates of gonioscopy and visual field tests during initial evaluations is that patients had these tests performed by their previous providers and made the test results available to their new eye care providers.

Fourth, we were unable to obtain eye care records for one third of the patients with POAG who responded to the patient survey. The care of these patients may differ systematically from the care of patients whose records were available for abstraction.

Fifth, the patients in this study were mostly white, and all had commercial health insurance. Our findings may not be generalizable to the care received by patients of other races or ethnicities, especially African Americans, or by patients with other types of insurance.

Last, we could not assess differences in care provided by ophthalmologists and optometrists. Only 9 of 108 eye care practices in the study were staffed exclusively by optometrists, and only 20 patients were treated in these practices. The findings of the study did not change when we repeated the analyses after excluding the 20 patients treated in optometry practices.

This study suggests that, in many respects, patients with glaucoma are receiving care that is consistent with recommendations in the Academy of Ophthalmology’s PPP, the leading set of practice guidelines for POAG. However, care is falling short of the standards set in the PPP in several important areas. With regard to processes of care, the nearly universal failure to document a target IOP level...
during the initial evaluation, the low rates of obtaining photographs or drawings of the optic nerve head, and the high percentage of excessively long intervals between visual field tests are especially noteworthy. With regard to IOP control and adjustments in therapy, our findings suggest that POAG may be often undertreated, at least relative to the standards for optimal preservation of visual function established by recent clinical trials.\textsuperscript{18-20} Widespread undertreatment of POAG could have substantial public health implications.

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Corresponding author and reprints: José J. Escarce, MD, PhD, RAND Health Program, 1700 Main St, PO Box 2138, Santa Monica, CA 90407-2138 (e-mail: jose_escarce@rand.org).

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