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Establishing a Regional Glaucoma Physician Collaborative to Improve Quality of Care

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Abstract

Purpose—Improving adherence to practice guidelines can improve patient safety and quality of care. We sought to establish a regional glaucoma physician collaborative to evaluate and improve adherence to the American Academy of Ophthalmology's Primary Open-angle Glaucoma (POAG) Preferred Practice Pattern (PPP) guidelines.

Design—Prospective interventional study. All consecutive POAG new patient visits were reviewed from each study site to determine physician adherence to the 13 major exam elements of the PPP.

Methods—The collaborative consisted of 13 glaucoma specialists from three practices in Michigan. In phase 1 of the study, physician adherence rates for each of the recommended examination elements were combined and averaged for all groups. Averages for the collaborative were reported to each site, and each physician received his/her individual adherence rates. Physicians discussed strategies to improve overall adherence to the PPP. Adherence rates were collected in phase 2 to determine if feedback and sharing of strategies resulted in improved adherence.

Results—274 new POAG patient visits from phase 1 and 280 visits from phase 2 were reviewed. After accounting for multiple comparisons, overall improvement approached statistical significance for the evaluation of visual function (91.2% to 96.1%, $p<0.02$) and target intraocular

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pressure determination (73.7% to 83.2%, p<0.01). Improvement for other measures that had a high rate of adherence at baseline (e.g. ocular history, pupil exam and central corneal thickness measurement) was not statistically significant.

Conclusions—It is feasible to establish a regional glaucoma physician collaborative to improve standardization of care for patients with newly diagnosed POAG.

Introduction

Glaucoma is a leading cause of blindness worldwide, and affects 2.1% of the population over 40 years of age in the United States.[1] Intraocular pressure (IOP) remains the only modifiable risk factor for disease progression. However, despite effective medical and surgical treatments to lower IOP, glaucoma still results in considerable blindness[2] and functional impairment.[3] In ophthalmology, as in other areas of medicine, increasing attention has been directed to employing standardized clinical practice guidelines, which can be used to improve patient safety, quality of care, and, ultimately, patient outcomes.[4–6]

Regional physician collaboratives have been established in other medical fields such as breast cancer, cardiovascular care, general, vascular and bariatric surgery[7,8] in order to improve quality of care though the collaborative sharing of ideas and deployment of best practices. Providers that participate in regional collaboratives receive regular feedback on their outcomes and adherence with established quality metrics. Providers and administrators meet to review their data and develop strategies to address areas of poor performance or variation in care. In other areas of medicine these initiatives have resulted in fewer complications, reduced morbidity and mortality, and a substantial cost savings to the healthcare system.[7]

To our knowledge, regional physician collaboratives have not been described in ophthalmology. However, several studies have demonstrated that there is considerable variation in adherence with preferred practice pattern (PPP) guidelines.[9–12] In one study, several major primary open-angle glaucoma (POAG) PPP examination elements including gonioscopy, central corneal thickness (CCT), and setting of target IOP were recorded for less than half of new patients with open-angle glaucoma.[10] We sought to address variation in adherence with the American Academy of Ophthalmology's POAG PPP guidelines[13] through the establishment of a regional glaucoma physician collaborative. In this proof of concept study, we hypothesized that data sharing and developing collaborative strategies for quality improvement would result in improved adherence with PPP guidelines.

Methods

This study was approved by institutional review boards at the participating institutions. We have followed the Standards for QUality Improvement Reporting Excellence (SQUIRE 2.0)[14] to present the methods and findings of this study.

Study Methods

In 2012, we established a regional glaucoma physician collaborative that included 13 glaucoma fellowship-trained ophthalmologists from three practices in Michigan. The

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participating practices included: one university-based academic practice with an ophthalmology residency; one hospital-based practice with an ophthalmology residency; and one community-based private practice. All consecutive POAG new patient visits at each site were reviewed to determine physician adherence to the 13 major examination elements recommended in the POAG PPP[13] (Table 1). Each PPP examination element from each new patient encounter during the study period was designated as a positive response if the specified information was found in the medical record or if there was a logical recorded reason for not performing that component of the examination (for example, if a visual field test was not performed because the patient brought a recent visual field from another physician's office).

In Phase 1 (July 2012–June 2013), adherence for each of the 13 recommended examination elements for all physicians were combined and averaged. The overall adherence statistics for the collaborative were reported to the group, and each physician received his or her individual adherence rates. During a conference call, the Phase 1 group results were discussed among the participating physicians to determine strategies and best practices for improving adherence. Additionally, the collaborative chose to implement two checklists. The first was the addition to participants' electronic health records of checkboxes for each required exam element and the second was to provide laminated pocket cards with a list of the exam elements. An ongoing e-mail discussion among participants was then initiated to review and share experiences with these strategies. Next, the same data were collected again in Phase 2 (August 2013–July 2014) to determine whether there was a change in adherence with PPP exam guidelines.

Statistical Analyses

Statistical analyses were conducted using SAS software, version 9.3 (SAS Institute Inc, Cary, NC). Positive responses to each exam element were tallied for each of the 3 participating practices and for the collaborative as a whole. The chi-squared or Fisher exact test was used to test for significant differences in the distribution of positive responses between Phase 1 and Phase 2 and two-sided p-values were calculated. We performed 13 hypothesis tests for each study site, therefore the Bonferroni method was used to adjust the level of statistical significance for multiple comparisons.[15] Accordingly, for all analyses, $p \leq 0.004$ was considered statistically significant. In order to determine the range of possible effect sizes supported by our data, we calculated Bonferroni-corrected Agresti-Caffo confidence intervals (CIs)[16] for the difference of adherence rates between Phase 1 and Phase 2 of our study. The intervals are simultaneous confidence intervals, each of which has 99.6% confidence; however, jointly they provide 95% confidence that all 13 true rate differences are within these intervals.

Results

A total of 554 patients underwent initial evaluation for POAG during the study period and all were included (Table 2). There were 274 (49.5%) patients in Phase 1 and 280 (50.5%) in Phase 2. The three participating practices (Sites A–C) cared for 345 (62.3%), 120 (21.7%) and 89 (16.1%) patients, respectively. Overall adherence was high for most exam elements.

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During Phase 1, all patients at each site had documented: visual acuity, IOP, examination of the optic nerve head/retinal nerve fiber layer and fundus, and a treatment plan. Site C had 100% adherence for all exam elements at baseline. Adherence was lowest in Phase 1 for setting of target IOP (71.3%, 61.7% and 100% at Sites A–C, respectively).

In Phase 2, overall adherence with PPP guidelines improved by 4.9% (95% CI −1.3, 10.9) for visual function (p=0.02), 9.5% (−0.6, 19.5) for target pressure (p=0.01), 0.4% (−1.4, 2.2) for ocular history (p=0.49) and 2.0% (−3.9, 7.7) for corneal thickness (p=0.32). Overall adherence decreased by 1.0% (−6.0, 4.1) for gonioscopy (p=0.56) and 2.5% (−6.4, 1.5) for visual fields (p=0.05). Although none of the aforementioned changes in adherence were statistically significant after accounting for multiple comparisons (corrected p-value ≤ 0.004), at Site A the rate of visual function assessment did increase significantly by 11.4% (1.1, 21.6) from 83.2% to 94.6% (p=0.0006).

Discussion

In this study of 554 patients with newly diagnosed POAG, we demonstrated the feasibility of establishing a regional glaucoma collaborative in order to improve adherence with practice guidelines. We found that adherence to POAG PPP guidelines was high at baseline across all study sites. However, among PPP exam elements with the lowest baseline adherence, we generally observed a trend toward improved adherence over the course of this study though this did not attain statistical significance in most cases.

The two exam elements with the lowest overall baseline adherence were assessment of visual function (91.2%) and recording of target IOP (73.7%). Although at Sites B and C, visual function was recorded for 100% of patients during Phase 1, only 83.2% had visual function recorded at Site A. This represented an opportunity for Site A to learn from the best practices of the other study sites and to integrate this exam element into their workflow. After the collaborative reviewed Phase 1 adherence data and discussed strategies for improvement, the frequency of visual function assessment increased significantly at Site A by 11.4% (1.1, 21.6) to 94.6% (p=0.0006). In contrast, the rate of target IOP documentation was low at baseline for both Sites A and B (71.3% and 61.7%, respectively). Therefore, physicians from each of these sites discussed the specific barriers to documentation of target IOP that they had encountered. Site-specific barriers were believed to vary due to differences in medical record systems, clinic workflow, and patient management styles. In Phase 2, following the meeting of the collaborative, documentation of target IOP showed a trend toward improvement, with frequencies at Sites A and B of 83.2% (p=0.01) and 80.7% (p=0.04), respectively, though these changes did not attain statistical significance (corrected critical value ≤ 0.004).

Albrecht and Lee evaluated adherence with an early version of the POAG PPP.[9] They found that documentation of recommended exam elements ranged from 70–100%. However, at the time of that study there were only five recommended exam elements for new patient evaluations. Several more recent studies have also evaluated adherence to PPP guidelines.[10,17] For example, Fremont et al examined the records of 395 patients with POAG in a managed care organization from 1997 to 1999. They found high rates of adherence for

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most exam elements, though only 53% of new patients had an optic nerve head photograph or drawing and 1% had a documented target IOP.[17] Similarly, Quigley and colleagues reviewed the charts of a nationally-representative sample of 300 patients with open-angle glaucoma who used a topical prostaglandin-analogue. They found that CCT was recorded for only 52% of patients and that target IOP was found in only 19% of charts.[10] It is possible that adherence rates for some exam elements were low in these two studies since patients were cared for by all types of eye care providers. In contrast, providers in our study were glaucoma fellowship-trained ophthalmologists who may be more familiar with practice guidelines. This is supported by a study by Zebardast and colleagues that compared PPP adherence rates for residents and glaucoma faculty at a single institution.[11] Documentation rates of PPP exam elements were significantly lower for resident physicians and rates among faculty glaucoma physicians were comparable to those found in our study. Finally, Ong et al studied the rate of PPP adherence for POAG follow-up exams by resident physicians.[12] They found high rates of compliance with most exam elements, though this study may not be fully comparable to ours since they did not study new patient evaluations.

In our study, adherence to PPP guidelines was already high at baseline and this may have left little room to detect an improvement, particularly at Site C where Phase 1 adherence was highest. Thus, it was difficult to detect a statistically significant change for most examination elements even though our study included more than 500 individuals undergoing new patient evaluations for POAG. In part, this was due to adjustment of our threshold of statistical significance to account for multiple statistical comparisons. By adjusting our critical value (corrected p-value ≤ 0.004) we decreased the likelihood of obtaining a statistically significant result due chance, however it is also possible that true improvements in adherence did not reach this more stringent level of statistical significance. To further address this issue, we calculated 95% CIs for the difference in adherence rates supported by our data. These CIs provide a measure of the certainty contained in our data given our sample size and study observations. Of note, adherence to practice guidelines is not uniformly high,[10,17] and using claims data researchers have demonstrated wide variation in the use of glaucoma diagnostic testing.[18–20] It would be useful in a future study to determine whether a physician collaborative would result in greater improvement and improved patient outcomes in a setting with poorer baseline adherence to PPP guidelines.

While our glaucoma collaborative remains in its early stages, regional collaboratives have existed for much longer in other areas of medicine and have yielded impressive results. For example, the Michigan regional collaboratives were initiated in 1997 by a large private insurer and include 20 separate collaboratives focused on common high-cost episodes of care.[7,21] In general and vascular surgery, the Michigan collaboratives' work has led to 2,500 fewer surgical complications and savings of around $20 million per year. Likewise, the Northern New England Cardiovascular Disease Study Group was founded in 1987 and is comprised of all medical centers in three northern New England states that perform coronary artery bypass graft and percutaneous coronary interventions.[8] One of the group's early interventions resulted in 34% fewer deaths than expected for patients undergoing these cardiac procedures. In our future work we will aim to learn from the successes of these established collaboratives in other areas of medicine. In doing so, we will seek to move beyond the measurement of process measures and to track clinical and patient-reported

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outcomes as well as costs of care in order to improve both the quality and value of glaucoma care.

There were several limitations to this study. First, physicians may have been motivated to adhere to guidelines since they had knowledge of this ongoing study throughout both Phase 1 and 2 and this may have contributed to high baseline adherence rates. Also, since different study sites and physicians in the collaborative had differing medical record systems, patient triage and work-up protocols, use of scribes, and styles of patient management, no single quality improvement strategy is likely to be effective for all members of a collaborative. It is possible that changes in workflow intended to improve adherence with specific exam elements also resulted in decreased adherence with other exam elements. For example, at Site B the rate of documented gonioscopy and visual field testing was high in Phase 1 but trended downward ($p>0.004$) in Phase 2 of the study and the reasons for this are not fully understood.

There were also a number of strengths to this study. The three practices that form our collaborative each represent a distinct practice setting and this improves the generalizability of our findings. Also, we included consecutive patients undergoing initial evaluation for POAG in order to obtain a non-biased sample and to control for the fact that some, but not all, patients were evaluated by a trainee in addition to an attending ophthalmologist. Finally, this study is the first description of a regional physician collaborative in ophthalmology and the methods and findings of this study may inform future efforts to collaboratively improve patient care and outcomes.

In conclusion, we found that through sharing of data and the collaborative exchange of ideas, there was a trend towards better adherence with PPP guidelines and achieving greater standardization of care for patients with POAG. Though this does not necessarily translate to improved patient outcomes, in future work we will apply the principles and methods of the collaborative to assess and improve other metrics, such as patient-reported (e.g. quality of life) and clinical outcomes (e.g. visual field progression). This proof of concept study suggests that collaboration between providers and practices may lead to greater standardization of care, and it is our hope that this will result in improved outcomes for patients with glaucoma.

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Table 1

Primary Open-Angle Glaucoma Preferred Practice Pattern Major Examination Elements

1.	Evaluation of visual function (e.g. documentation of visual problems or abilities)
2.	Ophthalmic history
3.	Visual acuity measurement
4.	Pupil exam
5.	Anterior segment exam
6.	Intraocular pressure measurement
7.	Gonioscopy
8.	Optic nerve head and/or retinal nerve fiber layer examination/analysis with documentation
9.	Fundus examination
10.	Central corneal thickness measurement
11.	Visual field evaluation
12.	Target intraocular pressure determination
13.	Treatment plan determination

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Table 2

Summary of adherence rates for exam elements by study phase

		Phase I N (%)	Phase II N (%)	Overall N (%)	p-value	95% CIs[d]
All Sites, Total Number Cases		274	280	554		
All Sites, Positive Responses[a]	**Visual Function**	250 (91.2)	269 (96.1)	519 (93.7)	0.02 [b]	−1.3, 10.9
	Ocular History	273 (99.6)	280 (100.0)	553 (99.8)	0.49 [c]	−1.4, 2.2
	Visual Acuity	274 (100.0)	280 (100.0)	554 (100.0)	-----	−1.5, 1.5
	Pupil Exam	273 (99.6)	280 (100.0)	553 (99.8)	0.49 [c]	−1.4, 2.2
	Anterior Segment Exam	274 (l00.0)	280 (100.0)	554 (100.0)	-----	−1.5, 1.5
	Intraocular Pressure	274 (100.0)	280 (100.0)	554 (100.0)	-----	−1.5, 1.5
	Gonioscopy	264 (96.4)	267 (95.4)	531 (95.8)	0.56 [b]	−6.0, 4.1
	Optic Nerve Head/Retinal Nerve Fiber Layer	274 (l00.0)	280 (100.0)	554 (100.0)	-----	−1.5, 1.5
	Fundus Exam	274 (100.0)	280 (100.0)	554 (100.0)	-----	−1.5, 1.5
	Corneal Thickness	256 (93.4)	267 (95.4)	523 (94.4)	0.32 [b]	−3.9, 7.7
	Visual Field	271 (98.9)	270 (96.4)	541 (97.7)	0.05 [b]	−6.4, 1.5
	Target Pressure	202 (73.7)	233 (83.2)	435 (78.5)	0.01 [b]	−0.6, 19.5
	Treatment Plan	274 (100.0)	280 (100.0)	554 (100.0)	-----	−1.5, 1.5
Site A, Total Number Cases		143	202	345		
Site A, Positive Responses[a]	**Visual Function**	119 (83.2)	191 (94.6)	310 (89.9)	0.0006 [b *]	1.1, 21.6
	Ocular History	142 (99.3)	202 (100.0)	344 (99.7)	0.41 [c]	−2.2, 4.0
	Visual Acuity	143 (100.0)	202 (100.0)	345 (100.0)	-----	−2.2, 2.6
	Pupil Exam	142 (99.3)	202 (100.0)	344 (99.7)	0.41 [c]	−2.2, 4.0
	Anterior Segment Exam	143 (100.0)	202 (100.0)	345 (100.0)	-----	−2.2, 2.6
	Intraocular Pressure	143 (100.0)	202 (100.0)	345 (100.0)	-----	−2.2, 2.6
	Gonioscopy	138 (96.5)	194 (96.0)	332 (96.2)	0.82 [b]	−6.6, 6.1
	Optic Nerve Head/Retinal Nerve Fiber Layer	143 (100.0)	202 (100.0)	345 (100.0)	-----	−2.2, 2.6
	Fundus Exam	143 (100.0)	202 (100.0)	345 (100.0)	-----	−2.2, 2.6

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		Phase I N (%)	Phase II N (%)	Overall N (%)	p-value	95% CIs[d]
	Corneal Thickness	139 (97.2)	192 (95.0)	331 (95.9)	0.32 [b]	−8.3, 4.4
	Visual Field	141 (98.6)	197 (97.5)	338 (98.0)	0.70 [c]	−5.7, 4.0
	Target Pressure	102 (71.3)	163 (80.7)	265 (76.8)	0.04 [b]	−4.2, 22.9
	Treatment Plan	143 (100.0)	202 (100.0)	345 (100.0)	-----	−2.2, 2.6
Site B, Total Number Cases		81	39	120		
Site B, Positive Responses[a]	**Visual Function**	81 (100.0)	39 (100.0)	120 (100.0)	-----	−9.0, 6.5
	Ocular History	81 (100.0)	39 (100.0)	120 (100.0)	-----	−9.0, 6.5
	Visual Acuity	81 (100.0)	39 (100.0)	120 (100.0)	-----	−9.0, 6.5
	Pupil Exam	81 (100.0)	39 (100.0)	120 (100.0)	-----	−9.0, 6.5
	Anterior Segment Exam	81 (100.0)	39 (100.0)	120 (100.0)	-----	−9.0, 6.5
	Intraocular Pressure	81 (100.0)	39 (100.0)	120 (100.0)	-----	−9.0, 6.5
	Gonioscopy	76 (93.8)	34 (87.2)	110 (91.7)	0.29 [c]	−25.4, 10.5
	Optic Nerve Head/Retinal Nerve Fiber Layer	81 (100.0)	39 (100.0)	120 (100.0)	-----	−9.0, 6.5
	Fundus Exam	81 (100.0)	39 (100.0)	120 (100.0)	-----	−9.0, 6.5
	Corneal Thickness	67 (82.7)	36 (92.3)	103 (85.8)	0.16 [b]	−9.8, 26.4
	Visual Field	80 (98.8)	34 (87.2)	114 (95.0)	0.01 [c]	−28.9, 4.5
	Target Pressure	50 (61.7)	31 (79.5)	81 (67.5)	0.05 [b]	−7.6, 40.8
	Treatment Plan	81 (100.0)	39 (100.0)	120 (100.0)	-----	−9.0, 6.5
Site C, Total Number Cases		50	39	89		
Site C, Positive Responses[a]	**Visual Function**	50 (100.0)	39 (100.0)	89 (100.0)	-----	−9.4, 8.4
	Ocular History	50 (100.0)	39 (100.0)	89 (100.0)	-----	−9.4, 8.4
	Visual Acuity	50 (100.0)	39 (100.0)	89 (100.0)	-----	−9.4, 8.4
	Pupil Exam	50 (100.0)	39 (100.0)	89 (100.0)	-----	−9.4, 8.4
	Anterior Segment Exam	50 (100.0)	39 (100.0)	89 (100.0)	-----	−9.4, 8.4
	Intraocular Pressure	50 (100.0)	39 (100.0)	89 (100.0)	-----	−9.4, 8.4
	Gonioscopy	50 (100.0)	39 (100.0)	89 (100.0)	-----	−9.4, 8.4
	Optic Nerve Head/Retinal Nerve Fiber Layer	50 (100.0)	39 (100.0)	89 (100.0)	-----	−9.4, 8.4

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	Phase I N (%)	Phase II N (%)	Overall N (%)	p-value	95% CIs[d]
Fundus Exam	50 (100.0)	39 (100.0)	89 (100.0)	-----	−9.4, 8.4
Corneal Thickness	50 (100.0)	39 (100.0)	89 (100.0)	-----	−9.4, 8.4
Visual Field	50 (100.0)	39 (100.0)	89 (100.0)	-----	−9.4, 8.4
Target Pressure	50 (100.0)	39 (100.0)	89 (100.0)	-----	−9.4, 8.4
Treatment Plan	50 (100.0)	39 (100.0)	89 (100.0)	-----	−9.4, 8.4

Abbreviation, CI: confidence interval

[a]'Positive Responses' refer to cases where the required information was presented, or if not, a reasonable explanation was provided for missing information (e.g. visual field test not performed because patient brought most recent visual field results from other doctor's office)

[b]Chi-square test

[c]Fisher exact test

[d]Bonferroni corrected simultaneous Agresti-Caffo CIs for the difference in adherence rates

[*]Statistically significant after accounting for multiple comparisons using the Bonferroni correction (critical p-value = 0.05/13 = 0.004)

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