Use of Optic Nerve Eval in Patients with POAG

Primary Open-Angle Glaucoma (POAG): Reduction of Intraocular Pressure (IOP) by 20% OR Documentation of a Plan of Care

Quality ID #141 | CMS Qualified Entity Annual Report

Prepared by: Kythera Labs

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About Kythera Labs

Kythera Labs is a healthcare data technology company committed to reducing uncertainty in healthcare data by making it more accurate, accessible, and trustworthy. We unify data science and modern technology to deliver high-fidelity, multi-source data representing over 300 million de-identified individuals, empowering healthcare and life sciences organizations to integrate, access, and analyze real-world data at scale. Our mission is to help innovators act decisively today while preparing for the challenges of tomorrow.

Purpose of This Report

The Centers for Medicare & Medicaid Services (CMS) Qualified Entity (QE) Program was established under the Affordable Care Act to promote transparency and improve healthcare quality by enabling certified organizations to access Medicare claims data. Through the Qualified Entity Certification Program (QECP), approved QEs combine Medicare data with other payer data to generate and publicly release standardized performance reports on providers and suppliers. These reports are designed to give patients, providers, and stakeholders a clearer picture of healthcare performance and outcomes, supporting informed decision-making and fostering accountability across the healthcare system.

This report evaluates care delivery for patients with primary open-angle glaucoma (POAG) using a CMS-defined clinical quality measure focused on treatment effectiveness and care management.

Study Overview

In this report, we evaluate real-world performance on a CMS-defined glaucoma quality measure using a large, nationally representative claims dataset. The analysis examines variation in measure performance across patient demographics, payer

types, and geographic regions, as well as differences in outcomes across providers managing patients with POAG.

Specifically, we assess whether patients achieve meaningful intraocular pressure (IOP) reduction or have appropriate care management documented when treatment goals are not met. Performance is stratified by age, gender, payer type, and state to identify patterns in care delivery and potential disparities in outcomes. In addition, provider-level performance is evaluated using volume-adjusted comparisons to distinguish expected variation from statistically meaningful differences.

Together, these analyses provide a comprehensive view of how glaucoma care is delivered in practice, highlighting both systemic trends and opportunities for improvement in clinical management.

What are We Measuring

Primary Open-Angle Glaucoma (POAG) is the most common form of glaucoma and a leading cause of irreversible blindness worldwide. It is a chronic, progressive optic neuropathy characterized by structural damage to the optic nerve and corresponding visual field loss. Because POAG often develops without noticeable symptoms until advanced stages, early detection and continuous management are essential to preserving vision and quality of life.

A central goal of POAG management is the reduction of intraocular pressure (IOP), the most significant modifiable risk factor associated with disease progression. Clinical treatment strategies—including medications, laser therapy, and surgical interventions—are primarily aimed at lowering IOP to slow or prevent further optic nerve damage.

This report evaluates care using CMS Quality Measure #141, which assesses whether glaucoma treatment has achieved meaningful clinical impact. Specifically, the measure captures the percentage of adult patients with POAG whose most recent

intraocular pressure has been reduced by at least 20% from pre-intervention levels, or for whom a documented plan of care is in place when this threshold is not met.

Unlike process-based measures that focus on whether specific evaluations are performed, this measure emphasizes treatment effectiveness and ongoing clinical management—reflecting whether care is successfully controlling disease progression or being actively adjusted when it is not.

Why Is This Measure Important

Evaluating the effectiveness of intraocular pressure reduction in patients with POAG is critical because sustained elevation of IOP is strongly associated with progressive optic nerve damage and irreversible vision loss. Clinical evidence demonstrates that lowering IOP reduces the risk of disease progression and helps preserve long-term visual function.

This measure is particularly important because it moves beyond assessing whether care processes were performed and instead evaluates whether treatment is achieving its intended clinical outcome. By incorporating both IOP reduction and the presence of a documented plan of care, the measure reflects the complexity of glaucoma management and the need for ongoing clinical decision-making when treatment goals are not met.

Performance on this outcome-based metric provides meaningful insight into the quality of glaucoma care being delivered. High performance suggests effective disease control or appropriate clinical response when control is not achieved, while lower performance may indicate gaps in treatment optimization or care coordination.

For CMS and other stakeholders, this measure offers a more direct assessment of whether care is improving patient outcomes, supporting efforts to advance value-based care and reduce preventable vision loss among patients with POAG.

Data Source

We used Kythera's Real-World Data medical claims dataset (mx_submits) as the analytical backbone. For the study period, claim-level records were pulled from the consolidated national union of professional and institutional claims. Dates were standardized by coalescing statement- and line-level fields into a single claim_date. An encounter identifier was derived as a hash of patient, provider, and date to support visit-level joins.

MIPS Clinical Quality Measure #141 (Primary Open-Angle Glaucoma: Reduction of Intraocular Pressure) defined the measurement specifications based on the CMS Quality Payment Program (QPP) measure documentation (1). The denominator population included patients aged 18 years and older with a diagnosis of primary open-angle glaucoma (POAG) and at least one qualifying face-to-face encounter during the performance period, as defined by CPT-based ophthalmologic or evaluation and management (E/M) services. Encounters associated with telehealth modifiers (e.g., GQ, GT, 95) or telehealth place of service codes were excluded, consistent with QPP specifications.

The numerator captured patients whose glaucoma treatment had not failed, defined as either (1) the most recent intraocular pressure (IOP) being reduced by at least 20% from the pre-intervention baseline, or (2) if this reduction was not achieved, documentation of a plan of care within the 12-month performance period. A plan of care may include actions such as rechecking IOP, modifying therapy, performing additional diagnostic evaluations, monitoring based on patient or system considerations, or referral to a specialist.

Value sets for POAG diagnoses and qualifying encounters were materialized by creating a function to retrieve OID-based value set contents from the Value Set Authority Center (VSAC), writing them into staging tables, and normalizing them to a measure-specific table. These tables supported downstream views for diagnosis inclusion and denominator eligibility. Cohort construction and eligibility definitions were aligned with QPP Measure #141 specifications (2). Patients with POAG were

identified in claims data and joined to the curated diagnosis value set. For each patient, we derived a first POAG diagnosis date, flagged those under 18 at diagnosis, and restricted claims to the 2024 measurement year.

Eligibility was determined using qualifying CPT encounter codes specified in the measure, ensuring alignment with CMS-defined visit types required for denominator inclusion. Telehealth encounters were excluded using modifier and place-of-service logic consistent with QPP guidance.

Because intraocular pressure (IOP) values and baseline comparisons are not directly available in standard 837 claims data, direct calculation of percentage reduction from pre-intervention levels was not feasible. Accordingly, numerator compliance was operationalized using claims-based proxies aligned to the intent of the measure, including evidence of glaucoma treatment management or documented follow-up care consistent with a plan of care when target IOP reduction was not achieved.

Patient-, provider-, and eligibility-level flags were consolidated into an analysis-ready final table. This table included evidence categories (treatment success inferred; plan of care inferred; no evidence of management; exception), patient age bands, and provider metadata (via NPI directory utilities). Additional derived features included flags for POAG diagnosis before age 18 and an indicator to restrict attribution to individual (Type I) rendering providers. Analyses were limited to valid, non-telehealth, adult POAG patients seen during the measurement period.

The final analysis table aggregated POAG patient counts and management indicators, with structured breakdowns by provider, age band, gender, payer type, and geography. Data were geographically restricted to the lower 48 U.S. states, and all missing, null, or unknown values were excluded prior to analysis.

Methodology

All analyses were conducted on the Databricks platform, using PySpark and SparkSQL for distributed data processing within a single Jupyter notebook for interactive, reproducible analysis.

For statistical comparisons, we applied two-proportion z-tests using the statsmodels.stats.proportion module to evaluate differences in procedure performance rates between two groups. Global differences in performance across multiple categories were assessed using chi-square tests of independence from scipy.stats. When overall chi-square tests were significant, post hoc pairwise group comparisons were conducted with multiple testing adjustment using the Holm method implemented in the multipletests function of statsmodels.stats.multitest to control the family-wise error rate. All visualizations were generated with the Matplotlib package.

Statistical Analysis of Gender

Differences in procedure performance rates between male vs. female patients were evaluated using a two-proportion z-test. This test compares the observed proportions of patients receiving the procedure in each group under the null hypothesis that the true proportions are equal. The pooled proportion across both groups was used to estimate the standard error of the difference in proportions. A z-statistic was calculated as the difference in observed group proportions divided by this standard error. Statistical significance was determined by comparing the resulting z-value to the standard normal distribution, yielding a two-sided p-value.

Statistical Analysis of Payer Type

We compared procedure performance rates across payer types using a chi-square test of independence applied to a 5×2 contingency table (payer type × procedure status). This test evaluates the null hypothesis that procedure performance rates are equal across payer types. Given the large sample sizes, we also computed group-specific performance rates (numerator ÷ denominator) and absolute differences between groups, accompanied by 95% confidence intervals. Pairwise comparisons

between payer types were explored with two-proportion z-tests and Holm's correction for multiple testing.

Findings

National Summaries

During the 2024 measurement period, the analytic cohort comprised 711,097 unique providers who collectively managed 10,175,919 patients with POAG. Among these providers, 1,814 performed IOP evaluations, accounting for the care of 43,798 POAG patients. Of these patients, 24,602 received documented IOP measurements, corresponding to a national performance rate of 56%. These values define the study cohort and establish the baseline performance benchmark for subsequent provider- and subgroup-level analyses.

Gender

Among the study population, 24,283 female patients with the diagnosis were identified, of whom 13,617 received the procedure, corresponding to a performance rate of 56%. In comparison, 19,515 male patients were identified, with 10,985 receiving the procedure, yielding a performance rate of 56%. Overall, procedure performance rates were similar between females and males.

Table 1. *National counts of POAG patients and intraocular pressure evaluation (IOP) by gender.*

Gender	POAG	IOP	Performance Rate
F	24,283	13,617	0.56
M	19,515	10,985	0.56

Age

Procedure performance rates varied across age groups. The highest rates were observed among younger patients, with 100% in those aged 0–18 years and 86% in those aged 19–34 years. Rates declined gradually with increasing age: 85% for ages 35–44, 73% for ages 45–54, and 61% for ages 55–64. Among older adults,

performance rates were 54% for ages 65–74, 55% for ages 75–84, and 63% for patients aged 85 and older. This pattern reflects an overall decline in procedure performance with increasing age through mid-to-late adulthood, followed by a modest rebound among the oldest age groups.

Table 2. *National counts of POAG patients and intraocular pressure evaluation (IOP) by age-band.*

Gender	POAG	IOP	Performance Rate
0-18	5	5	1
19-34	84	72	0.86
35-44	124	106	0.85
45-54	387	281	0.73
55-64	2,013	1,222	0.61
65-74	17,465	9,486	0.54
75-84	18,128	9,923	0.55
85+	5,592	3,507	0.63

Payer Type

Procedure performance rates differed across the major payer type categories ranging from 78% for Medicaid to 24% for Medicare Advantage. Original Medicare (59%) was higher than the national average (56%), while all other categories fell below the national average.

Table 3. *National counts of POAG patients and intraocular pressure evaluation (IOP) by payer type.*

Payer Type	POAG	IOP	Performance Rate
Original Medicare	36,359	21,302	0.59
Commercial	2,821	1,287	0.46
Medicare Advantage	1,067	255	0.24
Medicaid	74	58	0.78
Other	3,477	1,700	0.49
Aggregate	**43,798**	**24,602**	**0.56**

State

Compared to the national performance rate of 56%, state-level procedure performance rates varied, ranging from 22% (NM) in the lowest-performing state to 75% (MA) in the highest-performing states. This difference of 53 percentage points between the extremes, highlights meaningful geographic variation in procedure utilization.

Figure 1. *U.S. national choropleth map of performance rates for each state in lower-48 states.*

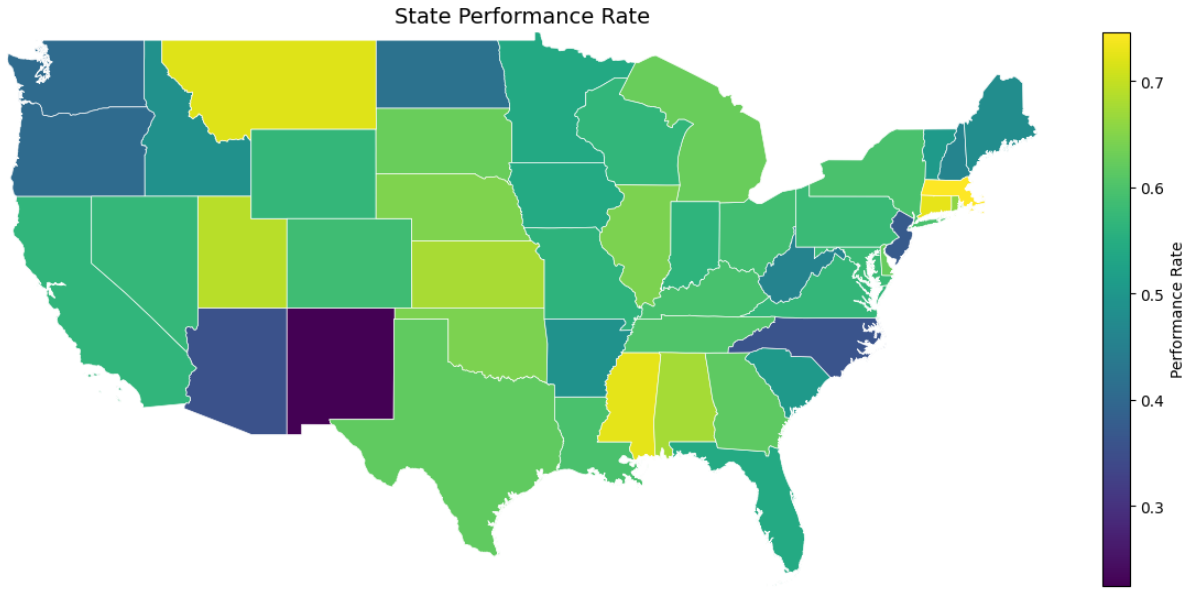


Table 4. *Counts and performance rates of POAG patients and intraocular pressure evaluation (IOP) showing top-10 states by performance rate.*

State	POAG	IOP	Performance Rate
MA	839	626	0.75
CT	209	152	0.73
MS	1,374	995	0.72
MT	197	142	0.72
UT	29	20	0.69
KS	1,307	885	0.68
AL	1,157	781	0.68
RI	35	23	0.66
NE	831	537	0.65
OK	1,028	661	0.64

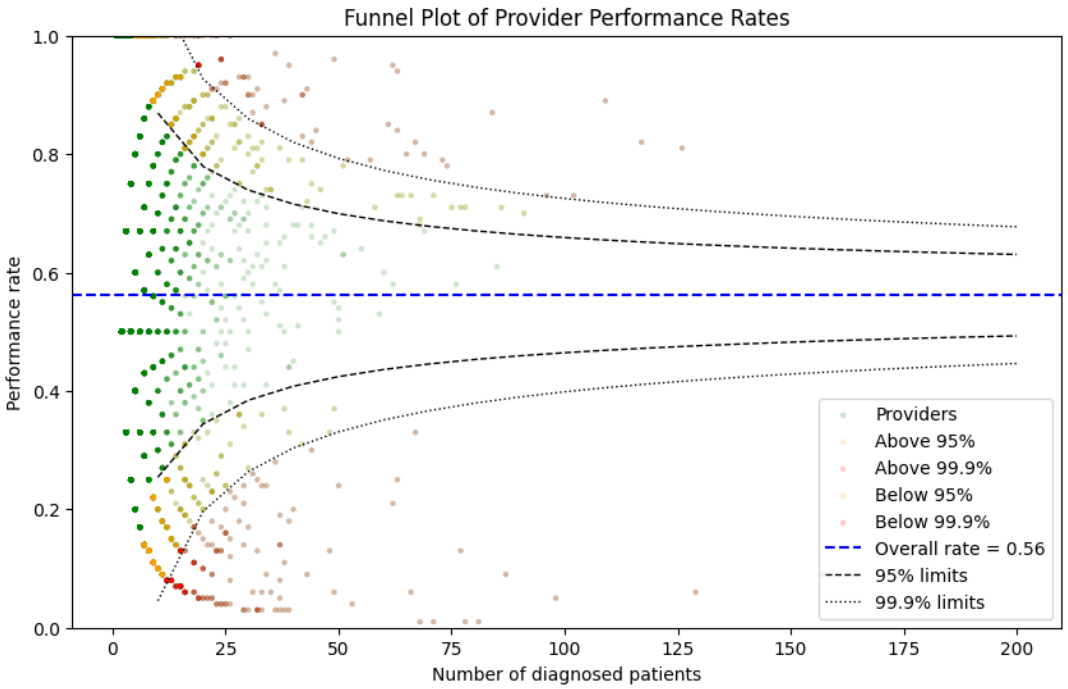
Table 5. *Counts and performance rates of POAG patients and intraocular pressure evaluation (IOP) showing bottom-10 states by performance rate.*

State	POAG	IOP	Performance Rate
ME	476	228	0.48
WV	1,012	463	0.46
NH	272	125	0.46
ND	76	32	0.42
WA	408	165	0.4
OR	141	57	0.4
NJ	2,359	872	0.37
NC	2,411	870	0.36
AZ	270	96	0.36
NM	40	9	0.22

Provider Performance

A funnel plot was used to evaluate provider performance, adjusting for variation in patient volume. The plot displays individual provider performance rate against the national average performance line (blue dash), with 95% (gray dash) and 99.9% (gray small-dash) confidence limits forming the funnel boundaries. This approach highlights providers whose performance deviates beyond what could reasonably be attributed to chance, while accounting for greater variability among low-volume providers. In this analysis, 88% (6,157) of provider–patient events fell within expected limits, 5.5% (389) were outside the 95% threshold but within 99.9%, and 3.4% (241) exceeded the 99.9% limits, indicating a small subset of providers with statistically unusual performance rates.

Figure 2. *Funnel plot showing provider performance rates (y-axis) by number of diagnosed POAG patients (x-axis).*



Statistical Analysis

Gender

Table 6. *Statistical analysis and results table for gender comparison.*

Female	Male	Absolute difference	95% CI lower	95% CI upper	z-statistic	p-value
0.56	0.56	0.00	-0.01	0.01	-0.45	0.65

There is no statistical evidence that the procedure performance rate differs significantly between genders.

Payer Type

Table 7. *Statistical analysis and results table for payer type comparison.*

Group 1	Group 2	Absolute difference	z-statistic	p-value	p-value (adjusted)
Commercial	Medicaid	-0.33	-5.577	0	0
Commercial	Medicare Advantage	0.22	12.356	0	0
Commercial	Original Medicare	-0.13	-13.426	0	0
Commercial	Other	-0.03	-2.585	0.0097	0.0097
Medicaid	Medicare Advantage	0.54	10.158	0	0
Medicaid	Original Medicare	0.20	3.453	0.0006	0.0011
Medicaid	Other	0.29	5.02	0	0
Medicare Advantage	Original Medicare	-0.35	-22.6	0	0
Medicare Advantage	Other	-0.25	-14.424	0	0
Original Medicare	Other	0.10	11.057	0	0

The global chi-square test indicated strong evidence of heterogeneity in procedure performance rates across payer types ($\chi^2 = 754.81$, dof = 4, $p < 1\times10^{-90}$). Performance rates varied across the major payer categories—Medicaid (78%), Original Medicare (59%), Commercial (46%), and Medicare Advantage (24%). These differences were not only statistically significant but also substantively meaningful, with notably lower performance among Commercial and Medicare Advantage patients compared with Medicaid and Original Medicare.

References

1. https://qpp.cms.gov/docs/QPP_quality_measure_specifications/CQM-Measures/2025_Measure_141_MIPSCQM.pdf

2. https://vsac.nlm.nih.gov/valueset/2.16.840.1.113883.3.526.3.326/expansion/eCQM%20Update%202023-05-04