

Prevalence, Incidence, and Treatment Characteristics of Primary Open-Angle Glaucoma Among Medicare Fee-for-Service Beneficiaries

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Purpose: This study aimed to describe Medicare FFS beneficiaries with prevalent and incident POAG, and to determine their demographic characteristics. Secondary objectives included describing POAG prescription rates, prescribers of POAG therapy, and dry eye disease rates among POAG prevalent beneficiaries.

Patients and Methods: The study was a retrospective cohort analysis using de-identified Medicare FFS medical and pharmacy claims and enrollment data (Parts A/B/D) spanning from January 1, 2016, to December 31, 2021. Medicare FFS beneficiaries were included in the analysis if they were diagnosed or treated for POAG, 65 years of age or older, and continuously enrolled for at least 24 months. Beneficiaries were identified between January 1, 2017, and December 31, 2021, allowing for a 12-month baseline to categorize patients as incident or prevalent. Comorbid dry eye disease and prescription POAG therapies were also identified. Prescriber NPIs were used to classify prescriber types.

Results: From 2017 to 2021, 5.5–6.2% of Medicare FFS beneficiaries were identified with prevalent POAG, with ~1% categorized as incident. A higher proportion of POAG beneficiaries were older and/or Black. At least 81% received POAG prescription therapy each year, with ophthalmologists as most frequent prescribers. Comorbid dry eye was documented in 16.4–18.7% of beneficiaries with prevalent POAG, and in 11.8–13.6% of beneficiaries with incident POAG.

Conclusion: A significant proportion of Medicare FFS beneficiaries have POAG. While most people with POAG received some type of prescription therapy each year, a notable proportion of individuals had no form of prescription POAG therapy identified. Given higher rates of dry eye disease in people with glaucoma, dry eye disease screening and care among beneficiaries with POAG should be promoted. Future research should evaluate treatment patterns and outcomes among Medicare FFS beneficiaries with comorbid POAG and dry eye disease.

Keywords: dry eye, glaucoma, race/ethnicity, prevalence, medicare, topical therapy

Introduction

Glaucoma is a group of eye diseases that can cause vision loss and blindness by damaging the optic nerve.^{1,2} In the United States, glaucoma accounts for 9–12% of all blindness, and is the second leading cause of blindness.^{3–5} The Centers for Disease Control and Prevention (CDC) report that the prevalence of glaucoma among Medicare Fee-for-Service (FFS) enrollees increased between 2014 (12.7%) to 2019 (13.6%).⁶ Glaucoma-related medical costs are considerable and increase as glaucoma progresses.⁷ On average, US patients with glaucoma incur an additional \$1,863 in healthcare costs each year, contributing to \$9.2 billion in annual national healthcare costs due to glaucoma.⁸ Consequent vision loss due to glaucoma significantly impacts employment and activities of daily life, such as driving and reading, and is associated with poorer quality of life and mental health.^{9–11}

Nearly 80% of glaucoma in the United States are open-angle glaucoma.¹² Idiopathic or primary open-angle glaucoma (POAG) is the most commonly diagnosed subtype of glaucoma.^{12–14} Risk factors for POAG include age, family history, African race or Latino/Hispanic ethnicity, and comorbidities such as Type II diabetes.¹⁵

POAG treatment typically aims to reduce or control intraocular pressure (IOP) and to prevent disease progression while preserving visual function and quality of life.¹⁵ Medical therapeutic options for POAG include prostaglandin analogs, beta-blockers, alpha-adrenergic agonists, parasympathomimetic agents, Rho kinase inhibitors, topical carbonic anhydrase inhibitors, and oral carbonic anhydrase inhibitors.^{15,16} Additional therapeutic options to lower IOP include laser therapy and surgery.¹⁵

Globally, over 79 million people aged 40–80 are expected to have POAG by 2040, with 4.2 million residing in North America.¹⁶ While more than 2.7 million Americans were estimated to have POAG in 2011,¹⁷ this number was expected to substantially increase as the US population grew and aged. Medicare FFS is a critical source of insurance coverage for the growing population of Americans over the age of 65, who are at particularly high risk of developing POAG and comorbid dry eye disease due to age and ocular surface changes.^{18,19} More recent CDC estimates in 2021 do not specifically address POAG and do not provide detailed prevalence and incidence data.²⁰ Clinicians and policymakers would benefit from updated information on POAG prevalence and incidence in the Medicare FFS population, which makes up a large share of ophthalmology visits and expenditures. Comorbid dry eye should also be evaluated, as development and/or presence of comorbid dry eye can potentially impact the pharmacotherapeutic management of POAG.^{18,21}

As a greater number of individuals in the American population age and utilize Medicare FFS, identifying recent trends in POAG prevalence and incidence among the at-risk Medicare FFS population becomes critical. To better understand patient characteristics and evaluate unmet need in screening, treatment, and comorbidity management, this study aimed to describe Medicare FFS beneficiaries with prevalent and incident POAG, and to determine their demographic characteristics. Secondary objectives included evaluating prescription rates, prescriber types for glaucoma therapy, and dry eye disease comorbidity rates among POAG prevalent beneficiaries.

Materials and Methods

Data Source

Retrospective, de-identified study data were derived from the complete Medicare FFS medical and pharmacy claims and enrollment data (Parts A/B/D) spanning from January 1, 2016, to December 31, 2021. The Medicare Master Beneficiary Summary File was used to determine continuous enrollment and patient demographics. National Provider Identifiers (NPI) in the Medicare claims and Part D Event (PDE) data were matched to the National Plan and Provider Enumeration System (NPPES) NPI Registry to identify prescriber primary taxonomy.

Study Design

The study was a retrospective cohort analysis of continuously enrolled Medicare FFS beneficiaries. Beneficiaries were identified between January 1, 2017, and December 31, 2021 to allow for a 12-month baseline period during which patients were categorized as having incident or prevalent POAG. Each year, either the date of beneficiaries' first POAG diagnosis, prescription, or procedure code was used as the index date. Patient demographics were captured on the index date. POAG medications prescribed during the mandatory 6-month post-index period were evaluated. For all POAG prescriptions given within 30-days of a POAG diagnosis, the count and proportion of POAG prescriptions prescribed by different clinician specialties were also evaluated.

Study Population

Medicare FFS beneficiaries were included in the analysis if they were 65 years of age or older at the start of the calendar year and were continuously enrolled for at least 24 months spanning the calendar year of interest and the year prior.

Inclusion in the POAG prevalent cohort required at least one of the following criteria within the calendar year of interest: ≥ 2 medical claims with a diagnosis of POAG at least 30 days apart, or ≥ 1 medical claim for POAG AND ≥ 1 medical claim for ocular hypertension at least 30 days apart, or ≥ 1 medical claim for POAG AND ≥ 1 medical claim for POAG-related procedure, or ≥ 1 medical claim for POAG AND ≥ 1 pharmacy claim for POAG-specific treatment in the 12-month baseline period. Patients were excluded if they had a diagnosis for any other glaucoma type. Inclusion in the incident POAG cohort also required that beneficiaries not have a diagnosis of POAG in the 12 months prior to index. [See [Supplementary Tables 1–5](#) for relevant diagnosis, procedure, and pharmacy codes.]

Beneficiaries in each calendar year were also included in the comorbid dry eye prevalence analysis if they were continuously enrolled for six months post-index. Beneficiaries with prevalent POAG were included in the therapy prescription analysis if they were continuously-enrolled for six months post-index.

Quantitative Analysis

For annual US estimates of POAG prevalence and incidence, the total number of Medicare FFS beneficiaries ages 65 and older that were continuously enrolled through January 1st of the previous calendar year until December 31st of the calendar year of interest served as the denominator in the calculation. The prevalence of POAG was estimated as the total number of prevalent cases, divided by the denominator (total number of Medicare FFS beneficiaries continuously enrolled in the prior and current year). Similarly, the incidence of POAG was estimated as the total number of incident cases, defined as the number of patients with POAG during the calendar year of interest who did not have a POAG diagnosis in the 12 months prior to index, divided by the denominator.

Dry eye was identified with two diagnoses of dry eye [see [Supplementary Table 6](#)] at least 30 days apart in the pre- and post-index period (the index date was randomly assigned for the full sample population).

The number and percentage of continuously enrolled prevalent beneficiaries that were prescribed a POAG therapy on or within six months after their index date each calendar year were evaluated to generate annual POAG therapy prescription rates. To evaluate proportion of POAG prescriptions prescribed by clinician types, prescriber NPIs were identified in prescription claims given within 30 days of a POAG diagnosis. Prescriber NPIs were used to identify prescribers' primary taxonomy. Counts and relative frequency of POAG therapy prescription were reported across clinician types.

Differences in patient characteristics and dry eye disease rates between beneficiaries with and without POAG and beneficiaries with prevalent or incident POAG were evaluated using chi-square tests. The output for this paper was generated using SAS software. Copyright© 2025 SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA.

The retrospective study design and de-identified data source meant that no direct subject contact or primary collection of individual human subject data was necessary for this research. IRB approval was not solicited because these data were derived from de-identified claims records under Section 164.514(a) of the HIPAA Privacy Rule.

Results

Study Population and Characteristics

Between 15,608,325 and 16,104,987 continuously enrolled Medicare FFS beneficiaries 65 years or older were identified in each year from 2017 to 2021 (see [Table 1](#) and [Figure 1](#)). Across years, the median ages were 74–75 and beneficiaries were most often female (58.7–60.0%), white (85.8–86.3%), and from the southern region of the United States (37.0–38.5%) (see [Table 2](#)).

Prevalent Patient Characteristics

Annual POAG prevalence rates ranged 5.5–6.2%, representing 888,790 to 983,429 Medicare FFS beneficiaries with POAG each year (see [Table 1](#)). Similar to the full sample, prevalent POAG beneficiaries were most often female (58.6–60.5%), white (79.1–80.4%), and from the southern geographic region (37.8–38.5%) (see [Table 2](#)). There were significant differences in age group at index ($p < 0.0001$) and race/ethnicity ($p < 0.0001$) between Medicare beneficiaries

Table 1 Medicare FFS Beneficiaries with Prevalent and Incident POAG, 2017–2021

Year	All Medicare FFS Beneficiaries, n (%)		Beneficiaries with Prevalent POAG, n (%)		Beneficiaries with Incident POAG, n (%)	
2017	15,608,325	(100.0%)	964,714	(6.2%)	178,829	(1.1%)
2018	15,845,532	(100.0%)	978,574	(6.2%)	172,557	(1.1%)
2019	16,017,447	(100.0%)	983,429	(6.1%)	168,440	(1.1%)
2020	16,104,987	(100.0%)	888,790	(5.5%)	137,169	(0.9%)
2021	15,843,936	(100.0%)	932,435	(5.9%)	209,352	(1.3%)

Abbreviations: FFS, Fee-for-service; POAG, Primary open-angle glaucoma.

with and without prevalent POAG. A higher proportion (39.7–42.2%) of prevalent POAG beneficiaries were 80 years of age or older compared to Medicare FFS beneficiaries (27.2–29.1%) without POAG. Moreover, 11.0–13.3% of beneficiaries with prevalent POAG were Black, compared to 5.0–6.3% of beneficiaries without POAG (see Table 2).

Incident Population Characteristics

Annual POAG incidence rates among eligible Medicare FFS beneficiaries ranged from 0.9% to 1.3% each year, representing 137,169 to 209,352 beneficiaries newly diagnosed with POAG each year (see Table 1). Incident POAG beneficiaries were also more often female (58.0–60.3%), white (77.0–78.7%), and from the southern region (36.7–38.4%) (see Table 3). Significant differences were observed at index in the age group ($p < 0.0001$) and race/ethnicity ($p < 0.0001$) between Medicare beneficiaries with and without incident POAG. Between 35.1% and 38.5% of beneficiaries

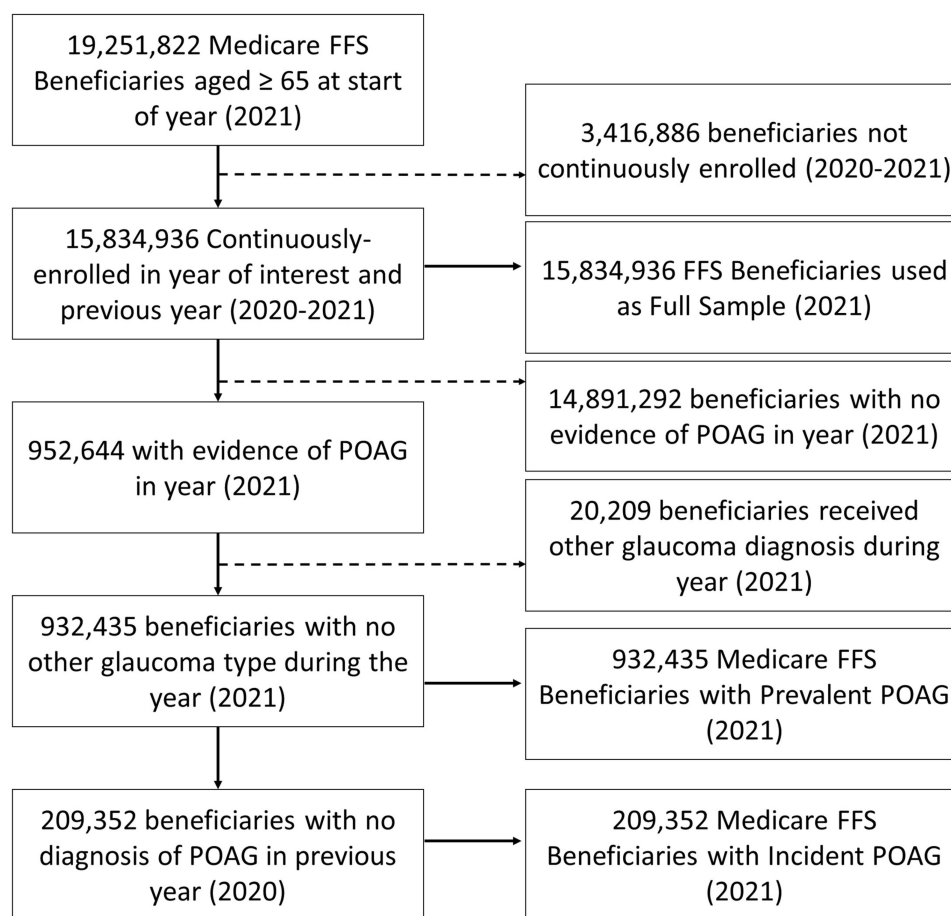
**Figure 1** Beneficiary selection and attrition, 2021.

Table 2 Characteristics of Medicare FFS Beneficiaries by POAG Prevalence Status, 2017–2021

Medicare FFS Beneficiaries	2017			2018			2019			2020			2021		
	Without POAG	With Prevalent POAG	P-value	Without POAG	With Prevalent POAG	P-value	Without POAG	With Prevalent POAG	P-value	Without POAG	With Prevalent POAG	P-value	Without POAG	With Prevalent POAG	P-value
Beneficiaries, N (%)	14,643,611	964,714		14,866,958	978,574		15,034,018	983,429		15,216,197	888,790		14,911,501	932,435	
Beneficiaries, %	93.8%	6.2%		93.8%	6.2%		93.9%	6.1%		94.5%	5.5%		94.1%	5.9%	
Age group at index date, %															
65-69 y	20.8%	14.3%	<0.0001	20.9%	14.2%	<0.0001	20.8%	14.2%	<0.0001	20.7%	14.3%	<0.0001	20.3%	13.8%	<0.0001
70-74 y	28.9%	21.6%		29.2%	22.0%		29.8%	22.3%		30.5%	23.3%		30.6%	23.9%	
75-79 y	21.2%	21.9%		21.4%	22.2%		21.4%	22.4%		21.2%	22.8%		21.9%	22.6%	
80+ y	29.1%	42.2%		28.5%	41.6%		28.0%	41.1%		27.6%	39.7%		27.2%	39.7%	
Sex, %															
Male	40.1%	39.5%	<0.0001	40.3%	40.0%	<0.0001	40.7%	40.6%	0.0003	41.1%	41.2%	0.0003	41.3%	41.4%	0.0121
Female	59.9%	60.5%		59.7%	60.0%		59.3%	59.4%		58.9%	58.8%		58.7%	58.6%	
Race/Ethnicity, %															
White	86.4%	79.1%	<0.0001	86.3%	79.2%	<0.0001	86.3%	79.2%	<0.0001	86.4%	80.1%	<0.0001	86.7%	80.4%	<0.0001
Black	6.3%	13.3%		6.1%	12.8%		5.8%	12.4%		5.5%	11.6%		5.0%	11.0%	
Hispanic/Latino	1.6%	1.9%		1.6%	1.9%		1.6%	1.8%		1.5%	1.6%		1.5%	1.6%	
Asian	2.1%	2.5%		2.2%	2.6%		2.2%	2.6%		2.2%	2.4%		2.2%	2.5%	
Other	1.9%	2.3%		2.0%	2.4%		2.0%	2.5%		2.0%	2.4%		2.0%	2.5%	
Unknown	1.6%	1.0%		1.9%	1.3%		2.2%	1.5%		2.4%	1.8%		2.7%	2.0%	
Geographic Region, %															
Northeast	19.7%	21.8%	<0.0001	19.5%	21.5%	<0.0001	19.3%	21.1%	<0.0001	19.2%	20.6%	<0.0001	19.3%	21.1%	<0.0001
Midwest	23.8%	22.4%		23.5%	22.2%		23.4%	22.0%		23.5%	22.3%		23.3%	22.0%	
West	18.8%	17.7%		19.4%	18.2%		19.6%	18.3%		20.0%	18.7%		20.4%	19.1%	
South	37.7%	38.1%		37.6%	38.1%		37.7%	38.5%		37.3%	38.5%		37.0%	37.8%	

Notes: Chi-square tests were used to compare patient counts between groups.

Abbreviations: FFS, Fee-for-service; POAG, Primary open-angle glaucoma; Y, Years.

Table 3 Characteristics of Medicare FFS Beneficiaries by POAG Incidence Status, 2017–2021

Medicare FFS Beneficiaries	2017			2018			2019			2020			2021		
	Without Incident POAG	With Incident POAG	P-value	Without Incident POAG	With Incident POAG	P-value	Without Incident POAG	With Incident POAG	P-value	Without Incident POAG	With Incident POAG	P-value	Without Incident POAG	With Incident POAG	P-value
Beneficiaries, N	15,429,496	178,829		15,672,975	172,557		15,849,007	168,440		15,967,818	137,169		15,634,584	209,352	
Beneficiaries, %	98.9%	1.1%		98.9%	1.1%		98.9%	1.1%		99.1%	0.9%		98.7%	1.3%	
Age group at index date, %															
65–69 y	20.4%	16.7%	<0.0001	20.5%	16.9%	<0.0001	20.5%	17.0%	<0.0001	20.4%	17.1%	<0.0001	20.0%	15.1%	<0.0001
70–74 y	28.6%	23.2%		28.8%	23.9%		29.4%	24.4%		30.1%	25.5%		30.3%	24.7%	
75–79 y	21.2%	21.5%		21.4%	21.8%		21.5%	21.9%		21.3%	22.4%		21.9%	21.8%	
80+ y	29.8%	38.5%		29.2%	37.5%		28.7%	36.7%		28.2%	35.1%		27.8%	38.4%	
Sex, %															
Male	40.0%	39.7%	0.0032	40.3%	40.5%	0.1581	40.7%	41.2%	<0.0001	41.1%	42.0%	<0.0001	41.3%	41.5%	0.0497
Female	60.0%	60.3%		59.7%	59.5%		59.3%	58.8%		58.9%	58.0%		58.7%	58.5%	
Race/Ethnicity, %															
White	86.0%	77.1%	<0.0001	86.0%	77.0%	<0.0001	85.9%	77.1%	<0.0001	86.1%	78.7%	<0.0001	86.4%	77.9%	<0.0001
Black	6.7%	13.9%		6.4%	13.3%		6.2%	13.0%		5.8%	11.9%		5.3%	11.7%	
Hispanic/Latino	1.6%	2.4%		1.6%	2.5%		1.6%	2.4%		1.5%	2.1%		1.5%	2.2%	
Asian	2.1%	2.9%		2.2%	3.2%		2.2%	3.0%		2.2%	2.7%		2.2%	3.3%	
Other	2.0%	2.5%		2.0%	2.6%		2.0%	2.7%		2.0%	2.6%		2.0%	2.8%	
Unknown	1.6%	1.2%		1.9%	1.4%		2.1%	1.7%		2.4%	2.0%		2.6%	2.2%	
Geographic Region, %															
Northeast	19.8%	21.7%	<0.0001	19.6%	21.5%	<0.0001	19.4%	21.2%	<0.0001	19.2%	20.5%	<0.0001	19.4%	22.1%	<0.0001
Midwest	23.7%	21.7%		23.4%	20.8%		23.3%	20.7%		23.4%	21.0%		23.2%	20.5%	
West	18.7%	18.6%		19.3%	19.5%		19.5%	19.7%		20.0%	20.3%		20.4%	20.7%	
South	37.7%	38.0%		37.6%	38.1%		37.8%	38.4%		37.4%	38.3%		37.0%	36.7%	

Notes: Chi-square tests were used to compare patient counts between groups.

Abbreviations: FFS, Fee-for-service; POAG, Primary open-angle glaucoma; Y, Years.

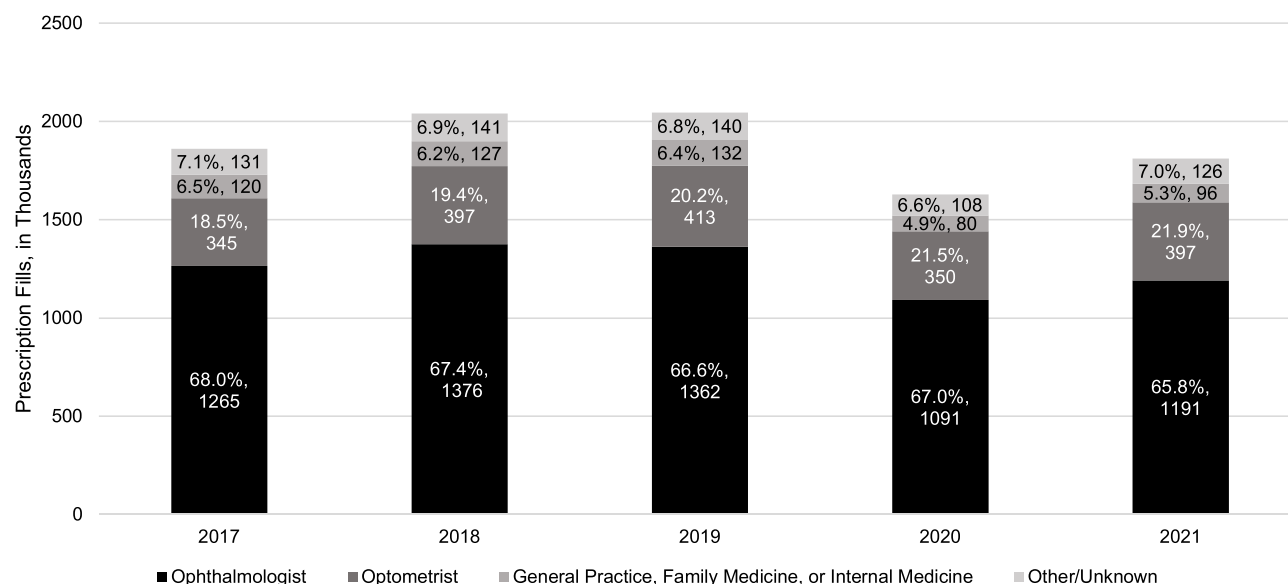


Figure 2 POAG therapies prescribed by clinician type.

with incident POAG were 80 years of age or older. Between 11.7% and 13.9% of beneficiaries with incident POAG were Black. POAG incidence vs group representation in the Medicare FFS database was greater for Hispanic/Latino (2.1–2.5% vs 1.5–1.6%) and Asian (2.7–3.3% vs 2.1–2.2%) patients (see Table 3).

POAG Therapy Prescribers

From 2017 to 2021, ophthalmologists prescribed 65.8–68.0% of POAG-related prescriptions filled within 30 days of diagnosis (see Figure 2 and Table 4). Optometrists prescribed between 18.5% and 21.9% of prescription therapies. General practice, family medicine, internal medicine, and other or unknown clinician types prescribed the remaining therapies.

POAG Prescription Therapy Rates

Among the POAG prevalent cohort, at least 81.3% filled one or more prescriptions for POAG each year (see Table 5). From 2017 to 2021, prostaglandins were the most prescribed therapy class (among 56.2–69.3% of POAG prevalent beneficiaries), followed by beta-blockers (37.5–39.9%), alpha-adrenergic agonists (19.0–23.1%), and topical carbonic anhydrase inhibitors (17.8–20.7%). Use of parasympathomimetic agents, Rho kinase inhibitors, and oral carbonic anhydrase inhibitors were identified in under 4% of beneficiaries each year.

Table 4 POAG Therapies Prescribed by Clinician Type, 2017–2021

Year	Ophthalmologist		Optometrist		General Practice, Family Medicine, or Internal Medicine		Other/Unknown	
	Prescriptions	(%)	Prescriptions	(%)	Prescriptions	(%)	Prescriptions	(%)
2017	1,264,728	(68.0%)	344,723	(18.5%)	120,178	(6.5%)	131,218	(7.1%)
2018	1,375,797	(67.4%)	396,782	(19.4%)	127,421	(6.2%)	141,024	(6.9%)
2019	1,361,627	(66.6%)	412,778	(20.2%)	131,856	(6.4%)	139,711	(6.8%)
2020	1,091,394	(67.0%)	349,514	(21.5%)	80,020	(4.9%)	108,045	(6.6%)
2021	1,190,838	(65.8%)	396,937	(21.9%)	96,122	(5.3%)	126,370	(7.0%)

Table 5 Medicare FFS POAG Prevalent Patients Prescribed Therapy, 2017–2021

Year	Denominator	Any Therapy		Prostaglandins		Beta-Blockers		Alpha-Adrenergic Agonists		Parasympathomimetic Agents		Rho Kinase Inhibitors		Topical Carbonic Anhydrase Inhibitors		Oral Carbonic Anhydrase Inhibitors?	
	N	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
2017	961,099	781,371	81.3%	540,386	56.2%	363,429	37.8%	219,653	22.9%	11,007	1.1%	<11	-	17,1352	17.8%	4,720	0.5%
2018	975,129	820,992	84.2%	599,257	61.5%	389,239	39.9%	225,196	23.1%	10,698	1.1%	2,162	0.2%	19,0762	19.6%	6,390	0.7%
2019	979,878	827,085	84.4%	610,703	62.3%	389,209	39.7%	215,093	22.0%	9,198	0.9%	17,458	1.8%	20,2828	20.7%	7,034	0.7%
2020	884,808	774,151	87.5%	610,762	69.0%	339,322	38.3%	186,997	21.1%	7,602	0.9%	24,295	2.7%	17,3718	19.6%	6,348	0.7%
2021	884,519	761,876	86.1%	613,148	69.3%	331,780	37.5%	167,828	19.0%	6,890	0.8%	29,207	3.3%	16,6316	18.8%	7,232	0.8%

Abbreviations: FFS, Fee-for-service; POAG, Primary open-angle glaucoma.

Comorbid Dry Eye Disease

Between 6.4% and 7.2% of the full Medicare sample had at least two documented diagnoses of dry eye disease each year, representing close to a million beneficiaries each year (see [Table 6](#)). Dry eye rates were significantly higher among beneficiaries with prevalent POAG ($p < 0.0001$) and incident POAG ($p < 0.0001$) than those without POAG; comorbid dry eye was documented in 16.4–18.7% of beneficiaries with prevalent POAG, and 11.8–13.6% of beneficiaries with incident POAG.

Discussion

Prevalence and Incidence

This study found that a significant proportion of Medicare FFS beneficiaries have POAG. Our results align with the estimates from the CDC Vision and Eye Health Surveillance System (VEHSS); the VEHSS estimates an overall glaucoma prevalence of 13.6% across Medicare FFS beneficiaries in 2019, with open-angle glaucoma estimated in 5.9% of beneficiaries.²⁰ However, our prevalence estimates were lower than Vajaranant et al's prospective, census-based projections of 3.7 million Americans with prevalent POAG by 2020, with more than 1.8 million ages 70 and older, but our study does not address those with undiagnosed glaucoma.¹⁷ Our findings were also slightly lower than a recent meta-analysis, which reported POAG prevalence rates of over 10% among North American individuals ages 70 and older, but authors noted that overestimation was possible since two of the three included North American studies evaluated open-angle glaucoma prevalence, rather than POAG prevalence.²²

We found that the largest population in the prevalent and incident POAG cohorts were non-Hispanic white women, aligning with previous research.¹⁷ It is likely that this is due to the demographic characteristics of the Medicare FFS population at large, rather than particular risk of POAG among this population. Our results also consistently align with previous research showing a higher POAG prevalence rate among Black and Hispanic/Latino individuals compared to white individuals (see [Table 1](#)).^{3,17,23–25} Given that the proportion of non-white beneficiaries was highest among beneficiaries with incident POAG, these findings suggest that the prevalence and demographics of Medicare FFS beneficiaries with POAG may continue to change as the US population grows older and more diverse.¹⁷ Findings from our study provide the premise for future research to evaluate differential access to glaucoma treatment, outcomes of glaucoma treatment, and management of comorbid dry eye disease across different socioeconomic and racial groups across the United States.

It should be noted that a portion of the data collection period coincided with the COVID-19 pandemic, during which time there was a restriction on access to care in the US. Consequently, the decreased prevalence of POAG seen in 2020 and increased incidence in 2021 may have been in part due to patients with POAG not seeking ophthalmic care during the pandemic in 2021, leading to their classification as incident when they resumed care in 2021.

Prescribers

The majority of POAG prescription claims were prescribed by ophthalmologists, indicating that they remain the clinician type most frequently responsible for therapeutic glaucoma care. We found that the proportion of POAG prescriptions prescribed by optometrists varied widely by geography, ranging from 0.9% of prescriptions in Massachusetts to 58.8% in South Dakota (see [Supplementary Table 7](#)). States with historically restricted optometrist scope of practice and prescribing ability, such as Massachusetts and California, had the lowest rates of glaucoma therapies prescribed by optometrists.^{26,27} It is expected that this will change given recent state legislative efforts to allow certified optometrists to prescribe therapeutics for the prevention and treatment of routine and uncomplicated glaucoma.^{28,29}

Therapy Prescription

The rates of prescription treatments identified in this study were higher than previous estimates; the CDC VEHSS reports national prescription therapy rate of 33% for Medicare FFS beneficiaries with any form of glaucoma in 2021.²⁰ This is likely in part due to the expanded list of prescriptions included in our analysis, but may also be due to differences in treatment rates between beneficiaries with POAG and other forms of glaucoma. Prostaglandins represent the most

Table 6 Medicare FFS Beneficiaries with Dry Eye by POAG Status, 2017–2021

Year	Continuously-Enrolled FFS Beneficiaries			Beneficiaries without Prevalent POAG			Beneficiaries with Prevalent POAG				Beneficiaries without Incident POAG			Beneficiaries with Incident POAG			P-value
	Total	With Dry Eye		Total	With Dry Eye		Total	With Dry Eye			Total	With Dry Eye		Total	With Dry Eye		
	N	N	%	N	N	%	N	N	%	P-value	N	N	%	N	N	%	
2017	15,543,548	997,615	6.4%	14,582,449	840,178	5.8%	961,099	157,437	16.4%	<0.0001	15,367,204	975,581	6.3%	176,344	22,034	12.5%	<0.0001
2018	15,778,031	1,092,088	6.9%	14,802,902	921,520	6.2%	975,129	170,568	17.5%	<0.0001	15,607,757	1,069,435	6.9%	170,274	22,653	13.3%	<0.0001
2019	15,948,028	1,148,585	7.2%	14,968,150	969,745	6.5%	979,878	178,840	18.3%	<0.0001	15,782,061	1,126,050	7.1%	165,967	22,535	13.6%	<0.0001
2020	16,031,070	1,038,925	6.5%	15,146,262	875,773	5.8%	884,808	163,152	18.4%	<0.0001	15,896,590	1,020,970	6.4%	134,480	17,955	13.4%	<0.0001
2021	15,037,742	968,702	6.4%	14,153,223	803,624	5.7%	884,519	165,078	18.7%	<0.0001	14,869,210	948,740	6.4%	168,532	19,962	11.8%	<0.0001

Notes: Beneficiaries in each calendar year were also included in the comorbid dry eye prevalence analysis if they were continuously enrolled for six months post-index. Dry eye was identified with two diagnoses of dry eye at least 30 days apart in the pre- or post-index period (the index date was randomly assigned for the full sample population).

Abbreviations: FFS, Fee-for-service; POAG, Primary open-angle glaucoma.

frequently prescribed therapy among patients with prevalent POAG. While few beneficiaries utilized other types of therapeutic agents, the use of Rho kinase inhibitors has grown since the first agent received United States Food & Drug Administration (FDA) approval in late 2017.³⁰

While our analysis found that most people with POAG received some type of POAG prescription each year, there is still a notable proportion (12.5% or greater) of individuals who had no form of prescription POAG therapy identified. Possible explanations for the significant proportion of untreated individuals include: laser and surgical therapy in place of medical therapy, observation of mild glaucoma without therapy, glaucoma suspects coded as primary open angle glaucoma, prescribed therapy not being obtained by patients, and prescription filling without use of insurance. Future research should evaluate the time to initiation of glaucoma prescription therapy and the proportion of Medicare FFS beneficiaries with POAG that receive non-pharmaceutical therapy such as minimally invasive glaucoma surgery or laser therapy, or no POAG therapy at all.

Comorbid Dry Eye

An estimated 6.8% of the overall US adult population has dry eye disease, with a higher likelihood of dry eye among older populations.³¹ Previous research has also found that dry eye disease occurs more often among patients with glaucoma than those without glaucoma, likely due to shared demographic and physical risk factors and ocular surface changes following the use of glaucoma medication or procedures like trabeculectomy.^{18,19} Our analysis showed similar findings, with higher frequency of diagnosed dry eye among patients with prevalent and incident POAG than the rates identified in the overall Medicare FFS population. Concurrent dry eye disease in POAG patients could potentially impact their adherence to glaucoma medications which could in turn worsen their pre-existing glaucoma leading to further vision loss. Given the high rates of dry eye disease among the Medicare FFS population with glaucoma, future research should investigate the incidence of dry eye after incident glaucoma and its relation to different treatments as well as its impact on adherence to glaucoma medications.

These findings emphasize the importance of promoting dry eye disease screening, awareness, and treatment among Medicare FFS beneficiaries with POAG. Due to their unique care needs, future research should evaluate treatment patterns and outcomes among the population of Medicare FFS beneficiaries with comorbid POAG and dry eye disease, including investigating whether dry eye disease has a material impact on adherence to glaucoma medication.

Limitations

This study was limited to Medicare FFS beneficiaries; consequently, results of this analysis may not be generalizable to patients with other commercial insurance, less stable insurance, those without health insurance coverage, or to younger patients. There is potential for misclassification of disease status, study outcomes, and covariates since claims data are subject to coding limitations, data entry errors, billing errors, or omissions. Patients not receiving eye care or erroneously not coded for glaucoma or dry eye may reduce the reported prevalence and incidence rates. Medications received as samples from physicians, inpatient medications, and prescriptions paid for exclusively out-of-pocket by patients are not captured. Calculations of medication usage were based on filled outpatient prescriptions; patients were assumed to take the medications as prescribed. The amount of eye drops used by the individual patient is not readily available.

Conclusion

A significant proportion of Medicare FFS beneficiaries have POAG, and a notable proportion of individuals receive no form of prescription POAG therapy. Glaucoma is more commonly diagnosed in elderly and Black patients. Given higher rates of dry eye disease in people with glaucoma, dry eye disease screening and care among beneficiaries with POAG should be promoted. Future research should evaluate treatment patterns, laser and incisional surgery utilization, and outcomes among Medicare FFS beneficiaries with comorbid POAG and dry eye disease.

Abbreviations

CDC, Centers for Disease Control and Prevention; FDA, Food & Drug Administration; FFS, Fee-for-Service; IOP, intraocular pressure; NPI, National Provider Identifier; NPPES, National Plan and Provider Enumeration System; PDE, Part D Event; POAG, primary open-angle glaucoma; VEHSS, Vision and Eye Health Surveillance System.

Disclosure

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References

- Harasymowycz P, Birt C, Gooi P, et al. Medical management of glaucoma in the 21st century from a canadian perspective. *J Ophthalmol*. 2016;2016:6509809. doi:10.1155/2016/6509809
- Weinreb RN, Aung T, Medeiros FA. The pathophysiology and treatment of glaucoma: a review. *JAMA*. 2014;311(18):1901–1911. doi:10.1001/jama.2014.3192
- Congdon N, O'Colmain B, Klaver CC, et al. Causes and prevalence of visual impairment among adults in the United States. *Arch Ophthalmol*. 2004;122(4):477–485. doi:10.1001/archophth.122.4.477
- Munoz B, West SK, Rubin GS, et al. Causes of blindness and visual impairment in a population of older Americans: the salisbury eye evaluation study. *Arch Ophthalmol*. 2000;118(6):819–825. doi:10.1001/archophth.118.6.819
- Quigley HA, Vitale S. Models of open-angle glaucoma prevalence and incidence in the United States. *Invest Ophthalmol Vis Sci*. 1997;38(1):83–91.
- CDC. Vision. Eye health surveillance system (VEHSS). 2025. <https://ddt-vehss.cdc.gov/>. Accessed August 15, 2025.
- Shih V, Parekh M, Multani JK, et al. Clinical and economic burden of glaucoma by disease severity: a United States claims-based analysis. *Ophthalmol Glaucoma*. 2021;4(5):490–503. doi:10.1016/j.ogla.2020.12.007
- Rasendran C, Li A, Singh RP. Incremental health care expenditures associated with glaucoma in the United States: a propensity score-matched analysis. *J Glaucoma*. 2022;31(1):1–7. doi:10.1097/IJG.0000000000001957
- Quaranta L, Riva I, Gerardi C, Oddone F, Floriani I, Konstas AG. Quality of life in glaucoma: a review of the literature. *Adv Ther*. 2016;33(6):959–981. doi:10.1007/s12325-016-0333-6
- Varma R, Lee PP, Goldberg I, Kotak S. An assessment of the health and economic burdens of glaucoma. *Am J Ophthalmol*. 2011;152(4):515–522. doi:10.1016/j.ajo.2011.06.004
- Rein DB, Zhang P, Wirth KE, et al. The economic burden of major adult visual disorders in the United States. *Arch Ophthalmol*. 2006;124(12):1754–1760. doi:10.1001/archophth.124.12.1754
- Mahabadi N, Foris LA, Tripathy K. Open angle glaucoma. *StatPearls*. 2023.
- S U, Barry MJ, Nicholson WK. Preventive services task force. screening for primary open-angle glaucoma: us preventive services task force recommendation statement. *JAMA*. 2022;327(20):1992–1997. doi:10.1001/jama.2022.7013
- Dielemans I, Vingerling JR, Wolfs RC, Hofman A, Grobbee DE, de Jong PT. The prevalence of primary open-angle glaucoma in a population-based study in The Netherlands. The rotterdam study. *Ophthalmology*. 1994;101(11):1851–1855. doi:10.1016/s0161-6420(94)31090-6
- American Academy of Ophthalmology. Primary Open-Angle Glaucoma PPP 2020. 2020.
- Tham YC, Li X, Wong TY, Quigley HA, Aung T, Cheng CY. Global prevalence of glaucoma and projections of glaucoma burden through 2040: a systematic review and meta-analysis. *Ophthalmology*. 2014;121(11):2081–2090. doi:10.1016/j.ophtha.2014.05.013
- Vajaranant TS, Wu S, Torres M, Varma R. The changing face of primary open-angle glaucoma in the United States: demographic and geographic changes from 2011 to 2050. *Am J Ophthalmol*. 2012;154(2):303–314e3. doi:10.1016/j.ajo.2012.02.024
- Nijm LM, Schweitzer J, Gould Blackmore J. Glaucoma and dry eye disease: opportunity to assess and treat. *Clin Ophthalmol*. 2023;17:3063–3076. doi:10.2147/OPHTH.S420932
- Schmier JK, Covert DW. Characteristics of respondents with glaucoma and dry eye in a national panel survey. *Clin Ophthalmol*. 2009;3:645–650. doi:10.2147/ophth.s8241
- Vision & Eye Health Surveillance System (VEHSS). CDC, vision health initiative. Available from: <https://ddt-vehss.cdc.gov/>. Accessed July 23, 2025.
- Stringham J, Ashkenazy N, Galor A, Wellik SR. Barriers to glaucoma medication compliance among veterans: dry eye symptoms and anxiety disorders. *Eye Contact Lens*. 2018;44(1):50–54. doi:10.1097/ICL.0000000000000301
- Zhang N, Wang J, Li Y, Jiang B. Prevalence of primary open angle glaucoma in the last 20 years: a meta-analysis and systematic review. *Sci Rep*. 2021;11(1):13762. doi:10.1038/s41598-021-92971-w
- Friedman DS, Jampel HD, Munoz B, West SK. The prevalence of open-angle glaucoma among blacks and whites 73 years and older: the salisbury eye evaluation glaucoma study. *Arch Ophthalmol*. 2006;124(11):1625–1630. doi:10.1001/archophth.124.11.1625
- Kim E, Varma R. Glaucoma in latinos/hispanics. *Curr Opin Ophthalmol*. 2010;21(2):100–105. doi:10.1097/ICU.0b013e3283360b1e
- Tielsch JM, Sommer A, Katz J, Royall RM, Quigley HA, Javitt J. Racial variations in the prevalence of primary open-angle glaucoma. The baltimore eye survey. *JAMA*. 1991;266(3):369–374. doi:10.1001/jama.1991.03470030069026
- American Optometric Association. Massachusetts scope win adds glaucoma authority. Available from: <https://www.aoa.org/news/advocacy/state-advocacy/massachusetts-scope-win-adds-glaucoma-authority?sso=y>. Accessed August 15, 2025.
- American Optometric Association. California amends optometry's approved treatments, medications and testing. Available from: <https://www.aoa.org/news/advocacy/state-advocacy/california-amends-optometrys-approved-treatments-medications-and-testing?sso=y>. Accessed August 15, 2025.
- Senate M. Senate No. 2984. 2020.
- Legislature C. AB-407 optometry: assistants and scope of practice. Assembly bill no 4072021.
- Tanna AP, Johnson M. Rho kinase inhibitors as a novel treatment for glaucoma and ocular hypertension. *Ophthalmology*. 2018;125(11):1741–1756. doi:10.1016/j.ophtha.2018.04.040
- Farrand KF, Fridman M, Stillman IO, Schaumberg DA. Prevalence of diagnosed dry eye disease in the United States among adults aged 18 years and older. *Am J Ophthalmol*. 2017;182:90–98. doi:10.1016/j.ajo.2017.06.033

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